ROADS And STREETS
Vol. 79 Number 7
A GILLETTE PUBLICATION
ESTABLISHED 1906

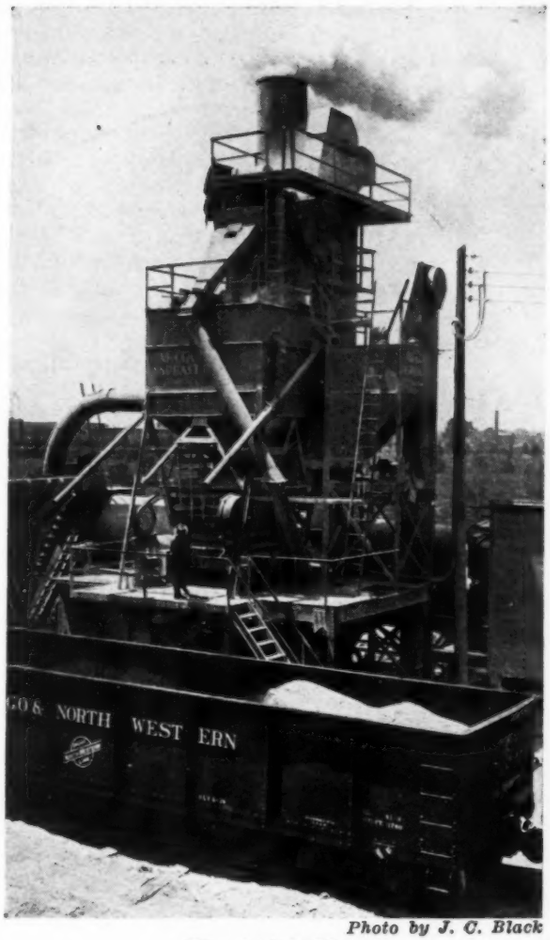


Photo by J. C. Black
The Asphalt Plant

NEW SURFACES ON OLD IN EVANSTON, ILL.

By JOHN C. BLACK,
Field Editor, Roads and Streets.

ONE and one-half inch and two inch asphaltic concrete surfaces are now being laid on some 35 miles of old macadam and brick (only a little of the latter) in the city of Evanston, Ill. By municipal bond issue and a PWA grant the city has available about $360,000 for street work, and it was decided that general welfare would be better served by applying this sum to the improvement of a large mileage than to the construction of a comparatively small amount of high type pavement.

As a matter of fact, for many years past, Evanston has faced a growing burden of maintenance on its old macadam pavements. The 35 miles now being covered with asphalt have an average age of 31 years, and at least one street dates back as far as 1889. Little comment is necessary regarding the condition of these surfaces. They have become a nearly solid mass of patches—the bane of motorists and the despair of maintenance crews.

The decision to resurface was made only after thorough studies by the city engineer and his assistants had shown its practicality. An important factor in the case is the character of the subsoil, which is nearly pure sand, affording excellent drainages and stability. The old waterbound macadam is from 8 to 10 in. thick. Pavement widths range from 24 to 44 ft.

The bond issue matures in 5 years, and the contractor's guarantee is for 3 years, but it is estimated that the actual useful life of the new surface will be from 15 to 20 years. Looked at in another way, the new surfacing will add that much to the life of the old macadam. Bond retirement is to be provided from motor vehicle tax funds.

Credit for promoting the project and seeing it through to its present active stage is due to numerous individuals and civic bodies, but more to the efforts of Mayor Charles H. Bartlett than to any other single source.

Pavement—Bids—Contract

THE 2-in. surfaces are designed as primary—the 1½ in. as secondary—selection between the two being based on character and volume of traffic. Primary surfaces total 141,500 sq. yd.; secondary surfaces 348,000 sq. yd. About 1 mile of similar work totalling 25,000 yards, completed earlier this year on Sheridan Road as a part of the state highway system, is not included in any of the figures here given. The current job was about 30 per cent complete on July 1.

To permit competition by small contractors, the streets were grouped according to location into 5 zones which were contracted separately. Bids were invited on 3 types of surface—

1. Asphaltic concrete, designated Class I by the U. S. Bureau of Public Roads.
2. Modified asphaltic limestone, designated Class G by the Bureau.
3. Road mix surface with open graded aggregate and cut-back asphalt binder, designated Class C. Finished thicknesses of 2¾ in. on primary

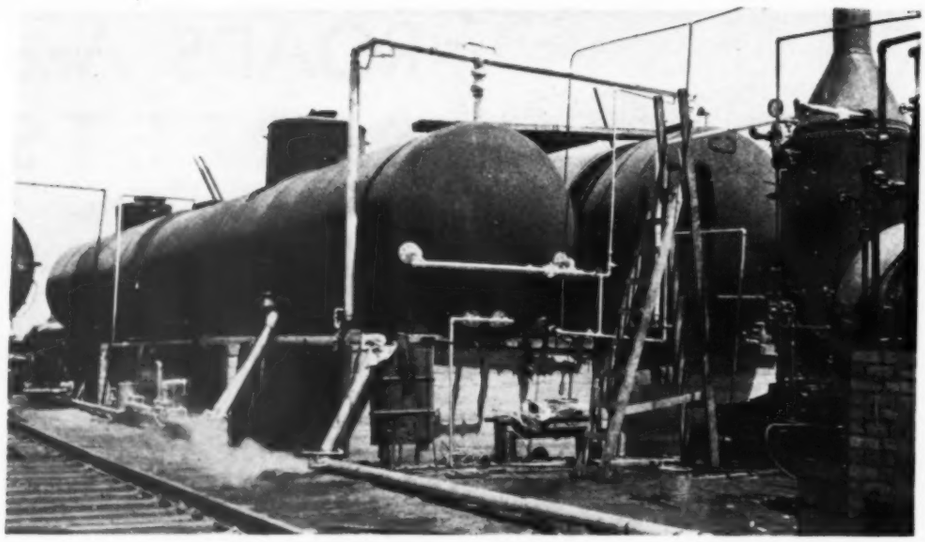


Photo by J. C. Black

Aasphalt Tanks and Piping. 40 H.P. boiler supplying steam is shown at right.

streets and 2½ in. on secondary were specified for this type.

Nine contractors responded to the invitation, but only one, the Arcole Construction Company of Chicago, bid on all 3 types, the totals of its bids for the 5 zones being:

Type 1	$359,927.50
Type 2	421,097.50
Type 3	329,667.50

As this company was low on each type in every zone, and as its responsibility was unquestioned, it was awarded the entire contract. Type 1 was considered sufficiently superior to Type 3 to warrant the $30,000 difference in price, and was accordingly selected.

The total contract for the 5 zones is as follows:

Catch basins, etc., adjusted 1565@$7.00	$ 10,955.00
Bituminous binder mixture 1970 ton@$8.50	16,745.00
Secondary wearing surface (1½ in.) 348,000 sq. yd. @$0.64	222 720.00
Primary wearing surface (2 in.) 141,500 sq. yd.@$0.74	104,710.00
Park basin inlets adjusted 520@$2.50	1,300.00
New Park basin inlets 155@$12.00	1,860.00
Concrete curb 1250 lin. ft.@$1.25	1,562.50
New catch basins 1@$75.00	75.00
Total Contracts	$359,927.50

Engineering and supervision are estimated to cost about $20,000, thus bringing the total for the 35 miles of street to approximately $380,000.

While bidding was for the most part reasonably close, one company which bid on Types 1 and 3 in 2 zones was approximately double the Arcole Co. in each instance.

Asphalt Mixing Plant

THE contractor established his mixing plant on a railroad spur at a point about 3 miles from the center of the paving job. The outfit, a product of Hetherington and Berner, is of the most modern semi-portable type. Its rated capacity of 75 tons per hour is frequently exceeded, and at times more than 100 tons of material is put through in a single 60 minute period.

All power is electrical, there being 11 separately controlled 3 phase 220 volt motors with a total of about 200 horsepower. All switches and other important control equipment are conveniently located in a small portable building. Among these features are automatic overload releases, and pilot lights for the immediate indication of interruption or stoppage of units which are not under the direct observation of the operators. Emergency power cut-offs are located at various strategic points.

The plant has been entirely free from mechanical trouble—a fact partly attributable to the use of special roller chain gears running in oil in dust-proof housings and to the use of dust-proof roller bearings throughout.

The limestone and the two kinds of sand used in the mix are taken from the stock piles or directly from the cars by a P. and H. Crane and clamshell and deposited in a bin having a separate section or compartment for each material. From there they are delivered mechanically to the cold elevator by an H. & B. feeder, through separately controlled gates regulating the quantity of each of the three aggregates.

Stone dust in bags is taken from the freight cars over a short gang plank into the dust house, where it is stacked pending use. The dust hopper, located in the corner of the house nearest the plant, is provided with a grill on which the bags are placed and through which they are emptied as required onto the screw conveyor below. Twenty or more bags can be placed on the grill at one time. From the screw conveyor the dust is elevated to the bin. Control is by a switch beside the scale dial at the mixer man's left

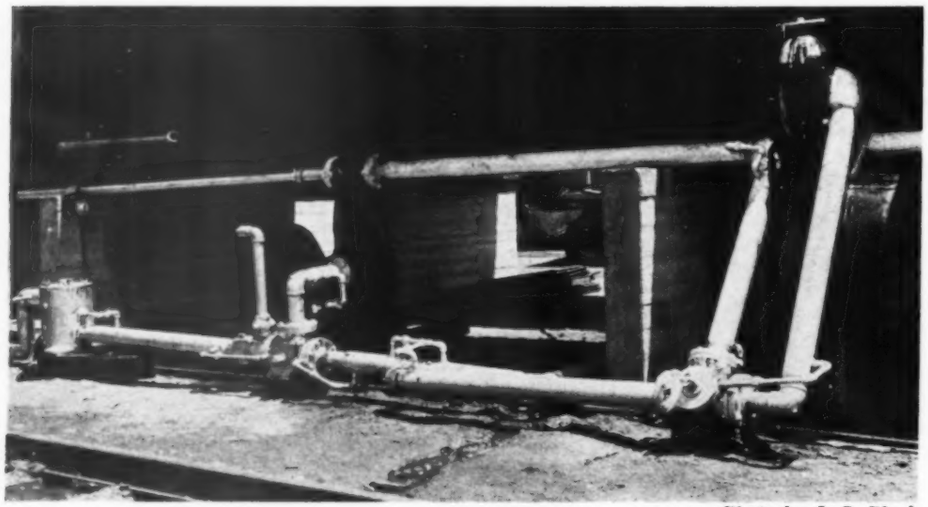


Photo by J. C. Black

A Close-up of Asphalt Piping and Equipment. Strainer at extreme left, pumps and connections near center, relief valve at top right. The small steam pipe connections around main joints and fittings are clearly shown.

hand. There is no trouble from excess weight or overdrawing of dust. The dust house, itself, is of panel construction, permitting easy take-down, shipment and re-erection.

The dryer is 30 ft. long and 70 in. in diameter. It is heated by three 6 in. air burners, no steam being used.

Heat for the asphaltic cement was at first supplied by a 40 H.P. upright boiler, which was barely adequate under favorable conditions, has therefore been supplemented with a 100 H.P. horizontal. The small boiler is still used on days of light run. Both boilers have 6 in. air burners.

All asphalt piping is steam-jacketed in a manner worth noting. The mixer is supplied by a single line of 3 in. pipe, each joint of which is jacketed with a 4 in. pipe welded to it at each end, with only enough of the 3 in. pipe protruding to provide for standard pipe fittings. A ¾ in. pipe is used for the steam connection between jackets. In detail, this comprises a short nipple screwed into each jacket near its end, an elbow attached to each nipple, and a short pipe and union connection between the elbows. Thus the steam is carried very simply and conveniently past the coupling of the 3 in. asphalt pipe, with no opportunity for condensation to reach the asphalt at any point in the line. The steam connection around valves and special fittings is somewhat more elaborate. This piping system was designed and constructed by the contractor's own force. An ordinary Crane water relief valve is used in the asphalt line but has been insulated to prevent sticking. This relief valve operates at 35 lbs. pressure. There is also a strainer to keep foreign bodies from getting into the main asphalt line.

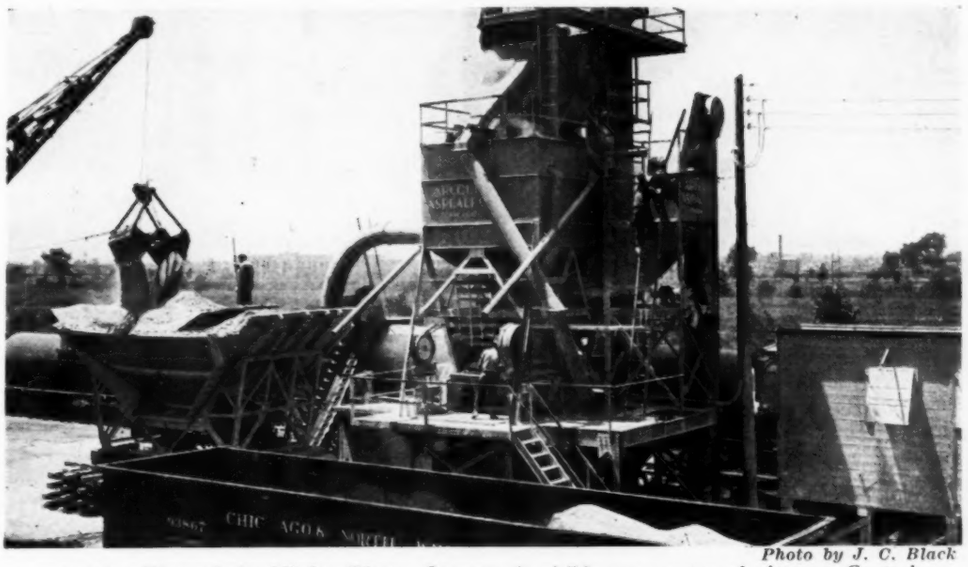


Photo by J. C. Black

Another View of the Mixing Plant. Operator is visible near center of picture. Control levers are in front of him, the 4000 lb. dial at his right and the 500 lb. dial at his left.

Mixer operation is simple and is easily handled by one man though it keeps him moving on a busy day. Four thousand pounds constitutes a batch. The 4 aggregate control levers (one for each class of material) are directly in front of the operator while a fifth lever controlling the asphaltic cement is in front and slightly to the right. A large, easily read, scale dial for measuring aggregates stands at his right hand, while an equally readable dial for the 500 lb. asphalt scale faces him from the left. Both scales are of Fairbanks make.

The crew of this plant is as follows:

1 foreman.
1 clerk.
1 crane operator.
1 car trimmer.
3 engineers.
1 oiler.
1 maintenance man (required by local union rules).
1 mixer man.
1 drum man.
4 general laborers (number variable).

The plant is operated on a single 12-hour shift, except for the engineers, who are on an 8-hour basis.

The foreman informed the writer that with a capable crew this plant can be erected complete in 2 or 3 days' time, although a longer period elapsed during erection on the present site because of delays in the delivery of certain items.

The Mix

THE specifications provide for the following proportions by weight:

Bitumen	5.0 to 7.5%
Mineral passing 200-mesh sieve	8.0 to 15.0
Mineral passing 80-mesh sieve	6.0 to 15.0
Mineral passing 40-mesh sieve	10.0 to 20.0
Mineral passing 10-mesh sieve	10.0 to 20.0
Mineral passing ⅜ cir. screen	15.0 to 30.0 } Total
Mineral passing ⅝ cir. screen	5.0 to 20.0 } 40 to 50%
Mineral passing ¾ cir. screen	0.0 to 15.0 }

The coarse aggregate (all material retained on a 10-mesh sieve) is crushed limestone supplied by Dolese & Shepard from their plant at McCook, Ill. The sand (all passing a 10-mesh and retained on a 200-mesh sieve) is of 2 sorts—lake and torpedo—all washed and proportioned to meet the specification requirements. The filler is a limestone dust, weighing 90 lb. or more per cu. ft. and at least 60 per cent passing a 325-mesh screen.

The asphaltic cement is supplied by The Texas Company in tank cars to meet the following specifications:

1. Flash Point, Cleveland Open Cup	Not less than 446° F.
2. Loss on heating, 325° F.	Not more than 1%
(a) Penetration of residue, in terms of original sample	Not less than 60%
3. Ductility at 70° F. 5/60	Not less than 100 cm.
4. Ductility at 372° F. 5/60	Minimum of 1 less than one-tenth of penetration at 77° F.; in centimeters.
5. Penetration at 77° F. 100/5	50 to 70 (as required)
6. Bitumen soluble in CS_2	99.5+%
7. Proportion of Bitumen Soluble in CCl_4	99+%
8. Oliensis Spot Test	Negative
9. Fluidity Factor	140+

The densities of specimens taken from the finished pavement range between 2.30 and 2.35, or about 98½ per cent of the theoretical maximum density.

Photo by J. C. Black

Fifteen-ton Austin Rollers Working Behind Paving Machines

Construction

THE first step in the street work is the adjustment nanhole tops and catch basins to proper elevation. Following that, all loose material in gutters or elsewhere is picked and shoveled out and the entire surface is cleaned by hand brooming. Holes and low spots are then filled with binder to bring the old base to as nearly uniform a surface as practicable. The specifications provide that a special coarse mixture may be used for this purpose, but the contractor finds it more economical to use the regular surface material than to prepare small quantities of the cheaper combination.

The surface is laid with 3 Adnun black top pavers working in parallel lanes, the machine in the first lane being followed closely enough by the one in the second to secure a hot joint between the 2 strips; while the second machine is similarly followed by the third. These pavers travel about 10 ft. per minute, counting only the the time they are actually moving. The foreman thinks it entirely practical to operate them at 25 ft. per minute should such speed be desirable.

The mix is delivered in 10-ton lots, the truck backing up to the paver, dumping a hopper full, and thereafter being pushed forward by the paver until its entire load is delivered. A 12-in. plank has been added to the front of each paver hopper, increasing its capacity to about 3 tons. When the writer visited the work, there were 8 trucks engaged in hauling mix.

Photo by J. C. Black

Truck Charging Paver Hopper. When hopper is filled, the paver will push truck ahead until the entire load is discharged.

Two hundred fifty degrees F. is the maximum permissible temperature of the mix when placed, but the actual temperatures range from 360° to 365°. This is an important factor in the attainment of high density. The maximum temperature permitted at the mixer is 400°.

It is obvious that on a base as irregular as that afforded by the old pavements, there must be considerable variations in thickness of the surface course. The specifications provide that the prescribed depth of surface shall be the average depth after final rolling, but inspection shows a considerably greater thickness, the prescribed depth being nearer the minimum than the average thickness. The old macadam crowns vary widely, but the paving machines are adjusted to provide for the differences.

The raking gang shapes the material at alley intersections, around street corners, and at any other points where departure from the standard surface profile is necessary. Rakers also accompany the machines to make any adjustments which may be necessary at the joints between lanes or elsewhere.

Old patchings containing tar which appears to be still active are covered with about ½ in. of limestone before the surface coat is laid. Sometimes, however, such spots are overlooked, and the tar, melted by the hot asphalt, softens the mixture. When this occurs, the damaged material is immediately removed clear down to the base and replaced with fresh mix.

Prompt rolling is another secret of the high density attained in the finished surface, 2 Austin-Western 3-wheel, 15 ton rollers being used for this purpose. They work immediately back of the pavers, sometimes almost touching them. Although both machines are of the "roll-a-plane" type, they are used as ordinary rollers, the "roll-a-plane" feature being considered unnecessary on this work. Final rolling is done with 2 Erie Machine Shop 10 ton steam tandems operating most of the time several hundred feet behind the others. The surfaces of the rolls on the first 2 machines are kept thoroughly wet, the water being applied through fiber mats. The paved surface receives a light treatment of limestone dust before final rolling.

The specifications permit a variation in finished surface of ¼ in. under a 10-ft. straight edge placed longitudinally, but in practice this maximum is almost never reached.

The work is conducted in two 6-hour shifts, the one following the other without intermission. On good days as much as 1,000 tons of surface material is laid. This means approximately 9,000 sq. yd. of the 2-in. surface or 12,000 sq. yd. of the 1½ in. Occasionally this record is exceeded. The average for the 22 days preceding the writer's visit was 800 tons. No street block is closed to traffic for more than 24 hours.

Photo by W. A. Dunn

Three Adnun Black Top Pavers Working Together on Keeney St.

Working Forces

Manhole Adjustment Crew.
1 foreman
1 compressor operator
8 laborers (excavating around manholes, etc.)
1 bricklayer
2 helpers
This crew works one 8-hour shift.

Binder Crew—Filling holes and low spots in pavement and excavations (around manholes and catch basins)
1 foreman
7 laborers
This crew works one 8-hour shift.

Paving Crew.
1 superintendent
2 foremen
3 paver operators
4 roller operators
8 truck drivers
30 (approx.) asphalt workers. Superintendent and foreman work 12 hours; machine operators, roller operators, truck drivers, and asphalt workers work 6 hours, and are then replaced by another shift of 7 operators, 8 drivers and 30 asphalt workers.

Clean-up Crew.
1 foreman
3 truck drivers
6 or 7 laborers
Foreman works 12 hours, truck drivers and laborers, 6 hours, and are then replaced by another shift.

Miscellaneous—(Placing and removing barricades and doing miscellaneous odd jobs)
1 truck driver
2 laborers
This crew works one 8-hour shift.

Labor rates are as follows in accordance with PWA requirements:

Trade or Occupation	*Per hour*
Rakers	$1.15
Smoothers	.95
Tampers	.95
Shovellers	.82½
Laborers	.82½
Paver Operators	1.65
Roller Operators	1.62½
Truck Drivers	1.00
Brick Layers	1.50

The work is conducted under George W. Craig, City Engineer and Commissioner of Public Works. John W. Cleveland, Assistant City Engineer, is in direct charge.

Field inspection and laboratory control are handled entirely by the Chicago Testing Laboratory, which makes daily reports to the city.

PWA maintains an inspector on the job at all times, in addition to which there is a daily inspection by a PWA district representative.

John Kearney is the contractor's superintendent on paving. P. E. Cassidy is foreman of the asphalt plant.

▼

First Large Tunnel in U. S. to Use Sodium Lights

Twenty 10,000-lumen sodium luminaries, to be furnished by General Electric, will continuously illuminate the 800-ft. Tooth Rock tunnel of the Columbia River Highway near Bonneville Dam, Ore. The golden light units will be supplemented by 1500- and 1000- watt incandescent lamps near the tunnel entrances during the time. Photo-electric tube equipment will turn on and off the incandescent lamps.

This will be the first large tunnel in the United States to be lighted by sodium units, and also the first to use supplementary portal lighting in this fashion.

Nine incandescent lamps over the right-hand driving lane at each end of Tooth Rock tunnel will prepare the motorist's eyes for the change from bright daylight to the tunnel's main illumination. The incandescent lamps will be spaced at 10- and 20-ft. intervals for the first 100 ft. of the tunnel, producing a high level of illumination, and gradually tapering down to the normal level within. The sodium lamps will be spaced at 40-ft. intervals and staggered through the tunnel.

Education and Occupation of Engineers

A SURVEY of the engineering profession was undertaken in May, 1935, by the Bureau of Labor Statistics of the U. S. Department of Labor at the request of the American Engineering Council. The data were obtained from a mail questionnaire sent to 173,151 professional engineers. A total of 58,388 questionnaires with information was returned; 5,883 or 3.4 per cent were returned as "not found" and no replies were received for 108,880, or 62.9 per cent. The net number of usable returns was 52,589. The nine major professional classes of engineers to which the questionnaires were sent and the number of replies from each class were as follows: Agricultural, 397; Architectural, 538; ceramic, 388; chemical, 3,512; civil, 19,891; electrical, 11,443; industrial, 1,007; mechanical, 13,226; mining and metallurgical, 2,187. Some of the facts developed in the survey are given in the Monthly Labor Review for June in an article prepared by Andrew Fraser of the Bureau's Division of Wages, Hours and Working Conditions. The following notes are abstracted from the article:

College Training of Engineers—Among the graduates who were in the profession for which they had specialized, the proportion having their first college degrees, ranges from 82.4 per cent for agricultural engineers to 95.9 per cent for industrial engineers. Among those who were in another engineering profession from that for which they had specialized, the range was from 75.0 per cent for ceramic engineers to 97.5 per cent for architectural engineers. Among all engineers reporting in each professional class, engineering graduates with first degrees ranged from 69.9 per cent of the architectural engineers to 79.7 per cent of the ceramic engineers. Hence, in each professional class as a whole the number of men with first degrees in engineering only strongly predominates.

Graduate study in engineering does not appear to be of any considerable importance as a prerequisite to practice in the engineering field. Of the graduates in engineering, those with master's degrees ranged from 3.6 per cent for industrial engineers to 17.2 per cent for agricultural engineers in the group practicing in the same profession for which they had specialized, and from 2.5 per cent for architectural to 25.0 per cent for ceramic engineers not in the same profession. Considering the grand total in each professional class, those with master's degrees ranged from 3.8 per cent of all the civil engineers reporting to 14.0 per cent of all the agricultural engineers reporting. This analysis seems to indicate that there has been little demand for master's degrees in engineering generally, although such degrees are evidently particularly important in certain professional lines, as in agricultural and chemical engineering, where the respective percentages are 14.0 and 10.9, followed closely by ceramic, mining and metallurgical, and electrical engineering.

None of the graduate architectural engineers who had specialized in that field in college had a doctor's degree in engineering. In the other professional classes the proportion with such degrees ranged from 0.2 per cent among the civil engineers to 6.2 per cent among the chemical engineers. Among the graduate engineers who were practicing in another branch of engineering work than that of their college course, none of the agricultural, architectural, or ceramic engineers had doctor's degrees; in the other branches of engineering the proportion ranged from 0.4 for mechanical engineers to 4.7 for mining and metallurgical engineers.

In regard to the extent to which engineers transfer from the course of specialization to other professional fields, it is sufficient to point out that the proportion of graduates whose course differs from their professional class ranges from 3.2 per cent among electrical to 35.8 per cent among industrial engineers.

As the table shows, of the 52,589 engineers reporting, only 4,413, or 8.4 per cent, were graduates in engineering who were practicing in another branch of the profession than the one for which they had qualified in college.

"Mortality" Among Engineering Students—Engineering educators have for many years been aware that the "mortality" (i. e., the proportion dropping out before completion of course) among engineering students is very high, this having been disclosed by many previous studies. The number covered by the present survey who reported that they did not finish the engineering course in college was 5,651, or 10.8 per cent of the total. Taking the individual professional classes, the largest percentage was found among civil engineers, 14.8, ranging from that point downward to 4.1 per cent among the ceramic engineers.

Non-collegiate technical-school engineers numbered 2,683 or 5.1 per cent of the grand total reporting. With reference to the individual professional classes, the largest percentages are found in mechanical, civil, industrial, architectural and electrical engineering, being respectively 6.7, 5.7, 5.2, 4.8, and 4.5, while the range for the four remaining classes is from 0.6 for chemical to 2.5 per cent for mining and metallurgical engineers.

Of 967 engineers reported as having had only a secondary-school education, the largest numbers were civil and mechanical engineers, the total of these being 756, or 78.2 per cent of the 967 reporting.

Fields and Functions of Civil Engineers—Data were requested as to the field of activity and the functional classification of the engineer. Only those engineers who had an engineering job as of Dec. 31, 1934, were interrogated on these points. The distribution of civil engineers by zones of interest and functional classifications in 1934 was as follows:

Classification	Civil Engineers	
Field of activity	Number	Per cent
Construction	2,148	15.4
Extractive industries	447	3.2
Public utilities	484	3.5
Transportation	517	3.7
Manufacturing	705	5.1
Personal service	808	5.8
Agriculture and forestry	....	....
Government work[1]	8,812	63.3
Total	13,921	100.0
Total not reporting	5,970	....
Functional classification		
Design and research	3,030	21.8
Construction	6,368	45.7
Operation	1,741	12.5
Consulting[2]	874	6.3
Teaching	553	4.0
Sales	175	1.2
General administration and management	1,180	8.5
Total	13,921	100.0
Total not reporting	5,970	....

[1]Includes federal, state, county and municipal.
[2]Includes independent consultants and employees of consulting firms.

Excavating, Hauling and Spreading for a Fill on the Blue Ridge Parkway.

DESIGN AND CONSTRUCTION FEATURES OF BLUE RIDGE PARKWAY

By H. J. SPELMAN

District Engineer, Bureau of Public Roads, U. S. Department of Agriculture, Washington, D. C.

THE construction of the Blue Ridge Parkway is being undertaken to meet the two-fold purpose of providing employment and of providing a new recreational area with a cool climate which will be readily accessible to an area of intense summer heat. The latest parkway standards of design are used. A large variety of location, design, and construction problems are met in a mountainous country of widely varying terrain. Construction is now under way on 119 miles of a total length of approximately 500 miles.

View of One Section of the Grade

Parkway to Be 500 Miles Long.—The Blue Ridge Parkway will be an elongated park extending from the southern limits of the Shenandoah National Park to the Great Smoky Mountains National Park. The route of the Parkway follows the Blue Ridge Mountains from the Shenandoah National Park south to the general vicinity of Mount Mitchell where it leaves the Blue Ridge and traverses intermediate ranges to the Great Smoky Mountains National Park. When completed the parkway will be about 500 miles long and, joined with some 100 miles of the Shenandoah National Park road now under construction, will provide a mountain parkway almost 600 miles long from Front Royal, Virginia, to the Great Smoky Mountains National Park. Lying almost entirely above the 2,500-foot elevation and rising at times to a mile above sea level, the route will afford recreational facilities in an area of unexcelled scenic attractiveness and cool summer climate to a large population within easy reach. It will also provide access from the north over a route of varied scenery and pleasant climate to a principal part of the southern Appalachian resort area.

The Blue Ridge Parkway was a logical development of the popular use of the completed portion of the Shenandoah Park road known as the "Skyline Drive." The Blue Ridge Parkway project was authorized in

Scraper Outfit on Grading Operations

December, 1933, by the Public Works Administration. As a result of proposals made by the states, it was agreed that the states of Virginia and North Carolina acting through their State Highway Departments would furnish the rights of way and the preliminary surveys for the Parkway, the Government assuming all other costs. Public Works funds, totaling $6,866,000, have been made available to date for the construction of the Parkway.

200 Ft. Right of Way Provided.—The right of way provided for the parkway is nowhere less than 200 ft., and will be accompanied by an additional strip averaging 800 ft. wide over which scenic easements will be obtained. These scenic easements provide for the control by the Government of all structures and other developments on such areas and will eliminate pole lines, trash heaps, and all buildings other than ordinary farm buildings within the areas covered by the easements. In addition to these parkway rights of way, which are being obtained by the states, the Government will acquire various tracts adjacent to the parkway for recreational development.

Power Shovel at Work on Rock Cut

Design Features.—The project has afforded and is affording a wide variety of problems of location, design, and construction. The road has been designed for a traffic of touring cars and busses. It is not expected that trucks other than light trucks needed for servicing the area will be permitted. There will be no railroad grade crossings and crossings with the most important highway routes will be separated. Local entry and local crossings will be restricted in number. The location has been selected to provide for a reasonably rapid movement of traffic. While maximum speeds attainable will not be as great as on the State highways in the adjacent valleys, yet because of the crossing separations, restricted entrances and the fact that the parkway will pass through no town or village, travel time for considerable distances will probably not greatly exceed that on state highways.

The most modern standards of mountain parkway alignment and grade are being followed. The grades generally do not exceed 7 per cent, there being a few short stretches of 8 per cent. The minimum radius of curvature is 200 ft. on "blind" curves and 150 ft. on open curves. All curves are spiralled and all curves sharper than one degree are superelevated. Four tunnels have been used on sections already designed and

Excavating with Power Shovel Served by Tractor Wagons

others may be found necessary on later sections. Heavy masonry walls on extremely steep sidehills are found necessary in places, to hold the road or to eliminate the unsightliness of side-hill waste. Likewise, hand-placed rock embankment on ¾ to 1 slopes is used in places to reduce the height of fills.

A crushed stone surfacing from the native materials along the road has been specified on the projects let to date. Where possible this material will be taken from the road cuts. Where this is impossible, quarries will be restricted to areas out of sight of the parkway and the adjacent countryside.

Headwalls of pipes and culverts will be of stone masonry. The bridges are of various types including stone, concrete, and steel.

The stripping of suitable topsoil within the roadway limits in advance of the grading and its subsequent replacement on the shoulders and slopes is provided for. In many of the sections a large percentage of the top-

Scraper Shaping Cut Slopes

soil is found suitable. In the rougher more mountainous sections, only a very limited amount is found.

119 *Miles of grading and Surfacing Now Under Construction.*—The first contract for 12.5 miles of grading and crushed stone surfacing was awarded on Aug. 23, 1935. Since that time contracts have been awarded on 12 additional road contracts, making a total of 119 miles of grading and crushed stone surfacing now under construction. Three bridge contracts, covering the construction of some 14 bridges ranging in span lengths from 20 to 70 ft., have also been awarded. The estimated cost of the work placed under contract to date, including the usual allowances for contingencies and supervision is $4,641,000.

One of the contracts provides for the completion of the parkway for approximately 8½ miles from the south end of the Shenandoah National Park to Rockfish Gap, at which point the east and west highway between Charlottesville and Staunton, Virginia, crosses the Blue Ridge. Other contracts provide for a section of parkway 47 miles long from Adney Gap, a point about 15 miles south of Roanoke to near the Meadows of Dan. Another section provided for is from the Virginia-North Carolina line south for 50 miles to Deep Gap, where U. S. Route 421 crosses the Blue Ridge, between North Wilkesboro and Boone, North Carolina. A fourth section being undertaken is between Buck Creek Gap and Bull Gap. From the latter point a highway already built leads to Asheville, N. C. Contract has recently been awarded on one project and plans are completed for the four other projects in this section.

Bid Prices.—The contracts awarded to date have varied in length from 3.5 miles to 13.2 miles. The yardage of excavation per mile has ranged from 23,000 to 87,000 cu. yds. The total yardage in any one individual contract has ranged from 234,000 cu. yds. to 592,000 cu. yds. There is also a wide range in the character of the material to be excavated, the proportion of rock and the hardness of the rock. These variations are reflected in the bid prices for the excavation, which is all on an unclassified basis, and in the bid prices for the crushed stone surfacing. The range of bid prices for excavation on the various contracts is from 25c to 54c per cubic yard, and on crushed stone surfacing is from $1.45 to $2.10 per ton. The high and low unit prices at which other principal items of road work have been awarded to date follow:

Clearing and Grubbing, per acre	$80.00	to	$300.00
Class A Concrete, per cubic yard	20.00	to	30.00
Class D Concrete, per cubic yard	20.00	to	27.00
Class A Cement Stone Masonry, per cubic yard	11.00	to	16.00
Class B Cement Stone Masonry, per cubic yard	10.00	to	15.00
Hand-placed rock embankment, per cubic yard	.75	to	2.00
Removing and storing topsoil	.25	to	.30

The first three contracts awarded were started last fall and all of the remaining contracts except two recently awarded were started early this spring.

Diesel Power Predominates on Grading Operations.—The grading operations are being conducted principally by power shovels and heavy dump wagons. The outstanding features of the excavation equipment are the predominance of Diesel power, the use of a number of 2-cu. yd. shovels, and the use of large capacity hauling units. Of 15 power shovels on the various contracts, only two are of the gasoline type of power unit, the others being of Diesel type power. The dipper capacity of the power shovels in use and the number of each is as follows: 5 of 2-cu. yd., 1 of 1¾ cu. yd., 8 of 1½ cu. yd., 1 of ½ yd. Each power shovel is served with either tractor type trucks or with crawler type wagons of 7 or 8 cu. yd. capacity. Lighter trucks are also on hand on a number of the contracts for supplementary service. Of some 24 air compressors in use on the various contracts, more than half are equipped with Diesel type power. The capacity of these compressors ranges from 60 cu. ft. to 450 cu. ft. The most popular type seems to be a compressor with a capacity of about 300 cu. ft. Heavy type bulldozers are in use on all of the contracts to spread and manipulate the materials on the dumps. On four of the contracts heavy scraper outfits of 8 to 12 yd. capacities are used on the earth sections. Grading work on the first project awarded last fall is now more than half completed and is well under way on all of the projects, except one awarded in June of this year.

Quarries have been opened on three of the projects and crushing stone for surfacing on these projects is well under way. The plants in use are laid out to permit an easy truck haul to the crusher mouth. After

Shovel at Work in Rock Cut

Shovel Pioneering on Side Hill

the first crushing the material is carried upward by elevators to the screen. The oversize material after passing through the screen drops to a second crusher where it is again crushed and reconveyed to the screen. The material is hauled directly from the bins to either the job direct or nearby storage. Large storage piles have been accumulated with a view to later speeding the work of completing the contract. On the first contract awarded several miles of stone surfacing had been placed by early in June.

Order of Work.—The order of work is practically the same on all of the projects. The necessary clearing is done by labor methods, supplemented by tractors to pull the stumps. The usable timber where any is found is piled along the right of way. Other material is burned within the roadway limits. Next, where available, the topsoil is stripped to a depth of 6 in., either with a power shovel or with a big scraper, and placed in convenient piles. Culverts and pipes are placed well in advance of the grading operations except those on sidehill sections. The drilling outfits then are moved in where rock is found and the drilling and shooting done. After the shooting the power shovel follows, the material being hauled to the dumps by the heavy wagons or tractor type trucks and spread in the fills by heavy bulldozers. End dumping of fills is permitted where the fills are deep. On steep sidehills, ditches are dug or felled timber is laid to catch the toe of the fills. The grade is kept smooth by the bulldozers and heavy graders. In some cases the cut slopes are trimmed with the big scraper and in other cases by the power shovel, supplemented with hand work.

Approximately 2,000 men were employed during May on the contracts under way, and it is expected that over 2,500 men will be required when all of the contracts now awarded get fully under way. All contracts operate in at least two shifts, employment being limited to 40 hours per week for all classes of labor.

The work is being done by the Bureau of Public Roads of the U. S. Department of Agriculture for the National Park Service of the U. S. Department of the Interior under the terms of an interbureau agreement. The engineering work is under the general supervision of the writer as District Engineer, and under the direct charge of Senior Highway Engineer Wm. M. Austin as Resident Engineer. The landscape and architectural work is under the supervision of T. C. Vint, Chief Architect of the National Park Service, with Stanley Abbott as Resident Landscape Architect.

Subgrade Reinforcement with Burlap

Burlap has been used on the subgrade of U. S. Highway 70 in Arizona with considerable success, according to an article by R. C. Perkins, District Engineer, State Highway Department, in the June Arizona Highways. We quote from his article:

"Back in November, 1934, we were having plenty of trouble with an old oil cake between Globe and Cutter on U. S. Highway 70. The cake was torn up and laid down on an average of once every two months and in some places oftener than that.

"As Texas and South Carolina were experimenting with cotton matting we decided to try burlap, which was the only material available. We bought No. 2 barley sacks in 200 and 400 lots. These sacks when split open make a mat of 9½ sq. ft. and cost 6 cts each.

"The old cake was torn up and laid aside, the subgrade was shaped up and a spray of hot oil (about ⅛ gal. per sq. yard) was applied. The burlap was then laid upon the newly prepared subgrade and another application of hot oil (⅛ gal. per sq. yard) was applied to the burlap in place. The old oil cake was then laid upon the burlap in the usual manner.

"Just what action the burlap has we do not know, but the oil cake that was placed on the burlap is still in place and in good condition. The oil cake on each side of the burlap has been torn up many times and is now being placed on burlap.

"Whenever we encounter bad clay mud subgrade we use burlap, as described above, and so far with good results. About 8 months ago we started to repair the old oil cake in the Claypool Tunnel, which is situated on U. S. 70 between Superior and Miami. This tunnel is hewn out of the solid rock but, as usual with all Arizona rock, is full of seams which, in this case, carry water nearly all year.

"The old cake had been replaced and added to until in places it was at least a foot thick. The subgrade in the tunnel is the worst kind of clay and always wet. It was a problem to repair the old cake and keep traffic moving. The road could not be closed because the only other road serving this territory was the Apache Trail, a crooked, narrow mountain road with many bridges that could not carry the heavy traffic.

"One half the tunnel was torn up at a time, the subgrade shaped and the same procedure used as stated above. Before the burlap was used it had been necessary to repair the oil cake at least once a week; it has now been 8 months since the burlap was used and only some minor repairs have been made, and these were caused by water pouring in from the top of the tunnel.

"The surface is in good condition and does not show any signs of cracking and going to pieces, as it has always done before.

"It seems the burlap forms a waterproof mat and also has a marked tendency to form subgrade reinforcement."

▼

Largest Mercury-Incandescent Street Lighting System in U. S.

Grand Island, Nebraska, a city of less than 19,000 population, will have the largest mercury-incandescent street lighting system in operation in the United States early in August. General Electric will furnish 166 combination incandescent-mercury units which will replace incandescent lamps in 5-light clusters now in operation in the city's business district. The new lights will be staggered six to a block.

SUCCESSFUL PIPE JACKING JOB AT PATTERSON, CALIF.

54-Inch Corrugated Pipe Siphon, 175 Feet Long Placed Under Railroad and Highway

By JOHN SILLERMAN

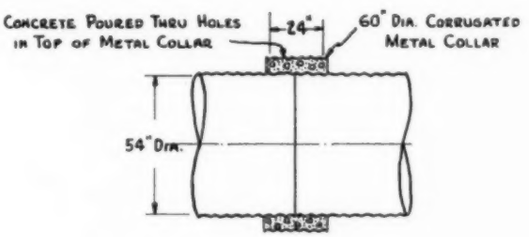
Engineer, Patterson Water Co., Patterson, Calif.

EARLY this year the Patterson Water Co. had occasion to place a 54-in. siphon underneath the main railway line and state highway at Patterson, a total distance of 175 ft. The portions directly under the railroad and the highway had to be jacked to avoid tearing up the track bed and the pavement. Armco corrugated pipe was selected for the purpose. This was close riveted and soldered and asphalt dipped at the factory. It was made up in the sections shown on the accompanying drawing. These were connected in the field by corrugated bands, reinforced with concrete collars, a method which has proven entirely satisfactory. The sketch shows the approximate locations of the railroad tracks and the highway. Section C and E, therefore, had to be jacked; the remaining portions were installed in the open trench.

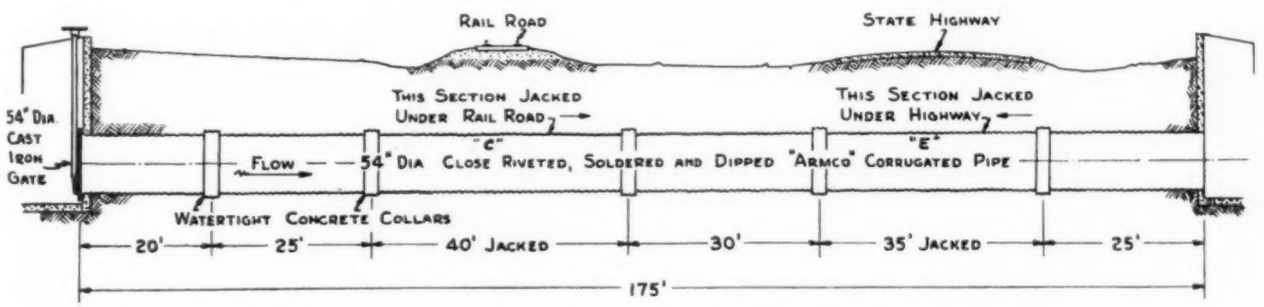
We started jacking under the railroad on a Saturday morning at 8:00 a. m. Because of the presence of two oil lines crossing the trench between the railroad tracks and the highway, we were forced to jack from the east side of the tracks instead of the west as had been planned. By 9:00 p. m. the pipe had been jacked 22 feet. Since there was one hour taken out for meals, the net working time was 12 hours or at the rate of 1.8 feet per hour. The soil is a clay loam.

Completed Installation. Slide Headgate in Foreground and Outlet Box in Background

It had rained considerably Friday evening and part of the time during the operations it poured. This necessitated a canvas roof over the A-frame, etc. The



Detail of Watertight Joint



Sketch Showing Approximate Location of Railroad and Highway and Details of the Joint

Placing the Section Under the Highway. Wheelbarrows Used for Removing Spoil

rain also started the end walls to slough, and we had to timber up both ends. After the 22 feet of jacking operations proper, the pipe was jacked on through the hole another 14 feet. This was completed at 3:30 a. m. Sunday. Level and alignment were found to be O. K.

The section under the highway had to be jacked through 30 ft. of ground. Work started one morning at 7:30 a. m. The second shift finished at 9:30 p. m., or 13 hours of work—one hour out for meals. This was at the rate of 2.3 feet per hour which, the pipe manufacturers tell us, is very good speed for a pipe of this diameter.

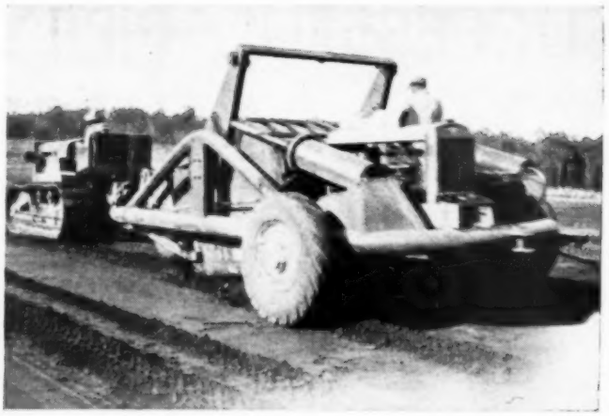
The concrete collars were poured and the pipe backfilled. This work was soon followed by pouring the walls for the inlet and outlet structures. A Calco slide headgate was installed at the inlet.

The job went through very satisfactorily, and the installation is now working to perfection. The only element we would modify if we had another similar installation to make is that of the concrete collars. These were 3 in. in thickness, and a greater thickness would have been so much more convenient to pour as to outweigh greatly the cost of the additional concrete necessary.

▼

Grading Airport at Iuka, Miss.

AIRPORT grading and road grading are as like as two peas in a pod. Five miles east of Iuka, Miss., the town is sponsoring a WPA airport grading project. Mr. Henry Marlar, superintendent

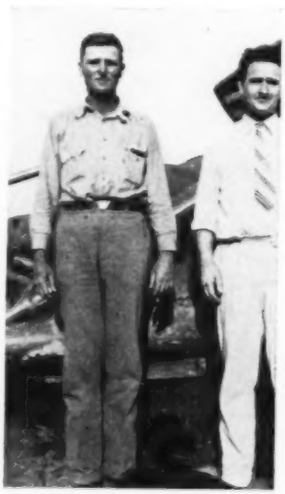


A C Model L Tractor and Midwest-Patterson 12-Yd. Scoop. Grading the Iuka, Miss. Airport on a Rental Basis to the WPA from Walter Froemming of Froemming Bros., Milwaukee

on the job, claims the Midwest-Patterson scraper which is pulled by an Allis-Chalmers Model L tractor, is moving around 125 cu. yds. an hour.

On this job the grading equipment is on a rental basis by Walter Froemming of Froemming Bros., Milwaukee, to the WPA. The average haul is 600 to 700 ft. Before grading started the land was quite rough and wooded. The soil is red, sandy, and hard packed. Unlike other digging scrapers, the Midwest Patterson operates on compressed air. The Waukesha engine and Ingersoll-Rand compressor unit mounted on the rear of the scraper automatically provides 120 lb. of compressed air for actuating the scraper bowl and apron. The pipe frame serves as an air storage reservoir. Each unit requires an operator. The tractor pulls the scraper to the site of the cut. By manipulation of the control levers on the scraper, the operator on the latter unit forces the cutting edge down. The depth of cut is controlled by this man and the edge held exactly in place by pressure on both sides of the piston actuating the bowl.

When the unit was first put to work it was equipped with swooth tread rubber tires. It was not long, however, before the engineers requested they be exchanged for a pattern type tire. The purpose of the change was to gain compaction of the fill to a better degree. The writer, in checking up on this feature, found that pattern treads actually give a compaction not given by smooth treads.



Henry Marlar (Left); J. Wesley Patterson (Right)

Being on a rental basis, the outfit is not pushed at top speeds. When asked as to why he used a gasoline tractor in preference to a Diesel, Mr. Marlar stated that he could easily get tractor skinners who could effectively and continuously operate a gasoline machine whereas to obtain Diesel tractor operators was difficult. The airport covers about 80 acres of rough land.

A NOVELTY: A SATISFIED CONTRACTOR

SEVENTEEN miles northeast of Kosciusko, Mississippi, in the heart of the hills, B. E. (Bunny) Bunnell is grading a 21 mile section of a State road. He is the member of the Rouse Construction Company who are proud of their job both financially and constructively. The job is broken into three parts. One crew is clearing and grubbing; one crew grading, and another team finishing.

Blasting for Clearing and Grubbing

Grades of 40 per cent are on the project where dynamiting operations for clearing and grubbing are in progress. Trees are sawed off about two feet above ground level. Five or six sticks of 40 per cent Hercules dynamite is used on the 12 inch stumps and a windlass then hooked on to pull the stump.

Bunny claims he is moving an average of 100 cu. yds.

Rouse Construction Company's A C Deisel 80 on a 24-Hour Day Dirt Job in the Hills of Mississippi, Loading a 10-Yd. Scraper

All Mechanical Units Were Well Lubricated with This Alemite Setup and Running Smoothly When the Writer Visited Bunny's Job

of earth an hour. Some hours it runs up to 125 cu. yds. The haul averages 500 to 600 feet. On this job of grading Bunny uses an A.C. Diesel 80 with Le Tourneau 10 yd. scraper. The rig was in hard dirt when the writer visited the job and usually only filled about ¾ full. The

Grading Crew on Job for Rouse Construction Company

rig works all day and all night. Mr. Brewer, the superintendent on the job says the 4 man crew change shifts each six hours. Only one man, of course, is operating on each shift. The rigs were all well lubricated and kept in good running order.

GREENDALE
. The Green Belt as it Appeared May Twenty-fifth About 300 Yards West of Broad Street

FEDERAL PROJECTS

Parklawn in Milwaukee and Greendale to the South Have Interesting Street Problems

Photographs by the Author

TWO projects—one urban, the other suburban—designed to provide good homes at rentals within the reach of small income workers were put under construction by Federal Agencies this Spring in Southeastern Wisconsin. Each is designed for a specific need, and is developed in detail accordingly.

We are indebted to the directors and others in charge of these projects for courtesies shown the author while visiting the sites and collecting information from officers.

PARKLAWN

PARKLAWN is the local name for the Public Works Administration's Housing Project No. H-1502, which is located on a 42-acre tract within the corporate limits of the city of Milwaukee, Wisconsin, within a 20-minute drive of the business center, and only ¼-mile by 3 different streets from a manufacturing district where some 7,500 people are now employed, and where many more will be added as business improves. Other important industrial areas are located from 1¼ to 1½ miles away. The ground is practically smooth, with a drop of 14 ft. from Southeast to Northwest corner.

General Character and Surroundings

Living units are to be provided for 518 families—an average of less than 13 families per acre. The project lies within a Milwaukee residential zone, as a consequence of which there will be no business developments on the tract. The possibility of a zoning change to admit stores was considered and rejected in view of the fact that there is a small district already zoned for commercial development only 2 blocks away in an area in which it can be extended as needed.

The only public buildings on the 42 acres will be a community house and a central heating plant. There are public schools about ¼-mile away in one direction and ¾-mile in another. A third school is projected at a point slightly less than ½-mile from the development.

The surrounding territory for a distance of several blocks in each direction is sparsely occupied, some of it still being in farm land. Such developments as have been made are of good character.

The prevailing winds blow from Parklawn toward the nearby industrial district, so that smoke, gases and odors will be carried safely away.

Plat and Layout

The Parklawn plat plan is noteworthy. The interior of the tract is reached by Parkway Drive—a one-way road entering from Lincoln Creek Parkway at the North, passing around a 6-acre park and playfield, and returning to Lincoln Creek Parkway for exit. This is the one main highway of the development. Narrow service drives enter from the surrounding streets. These drives terminate in paved areas, or "service yards" from 70 to 75 ft. square—a space large enough to permit both parking and turning. No vehicular thoroughfare crosses the tract.

Parkway Drive is planned for a 30 ft. pavement. Service drives have 16 ft. pavements with a 5 ft. walk on one side. All pavements, including the service yards,

PARKLAWN
Grading with Le Tourneau, Carryall Pulled by Diesel Caterpillar.

will be of 8-in. concrete conforming to the standard specifications of the city of Milwaukee, and provided with monolithic curbs. Walks will be of 5-in. concrete, also conforming to the city standards.

Back of each group of houses is a paved play area for small children, the pavement consisting of a 4-in. gravel or crushed rock base with a ¾-in. asphaltic surface.

Parkway Drive is 1,920 ft. long, while the service drives have a combined total of 980 ft.

Utilization of the net area will be approximately as follows:

	Acres	Percent
Buildings	5.63	15.70
Garages	0.57	1.57

HOUSING AND SETTLEMENT IN WISCONSIN

By JOHN C. BLACK
Field Editor, Roads and Streets

Service Drives and Courts	1.84	5.13
Auto Parking	1.03	2.86
Walks	4.82	13.43
Play Areas (surfaced)	1.93	5.38
Lawn Squares (paved)	0.85	2.40
City Park and Drive	7.11	19.80
Lawns and Shrub Beds	12.11	33.73
Total Net Area	35.90	100.00

The layout is entirely rectangular. The electric distribution system will be underground, as will also the telephone cables.

Building Construction—Public Utilities

Steam heat will be supplied to the entire development from a centrally located plant—a system which in view of the compact arrangement of the project, will probably be more economical than individual heating plants for the various buildings or units.

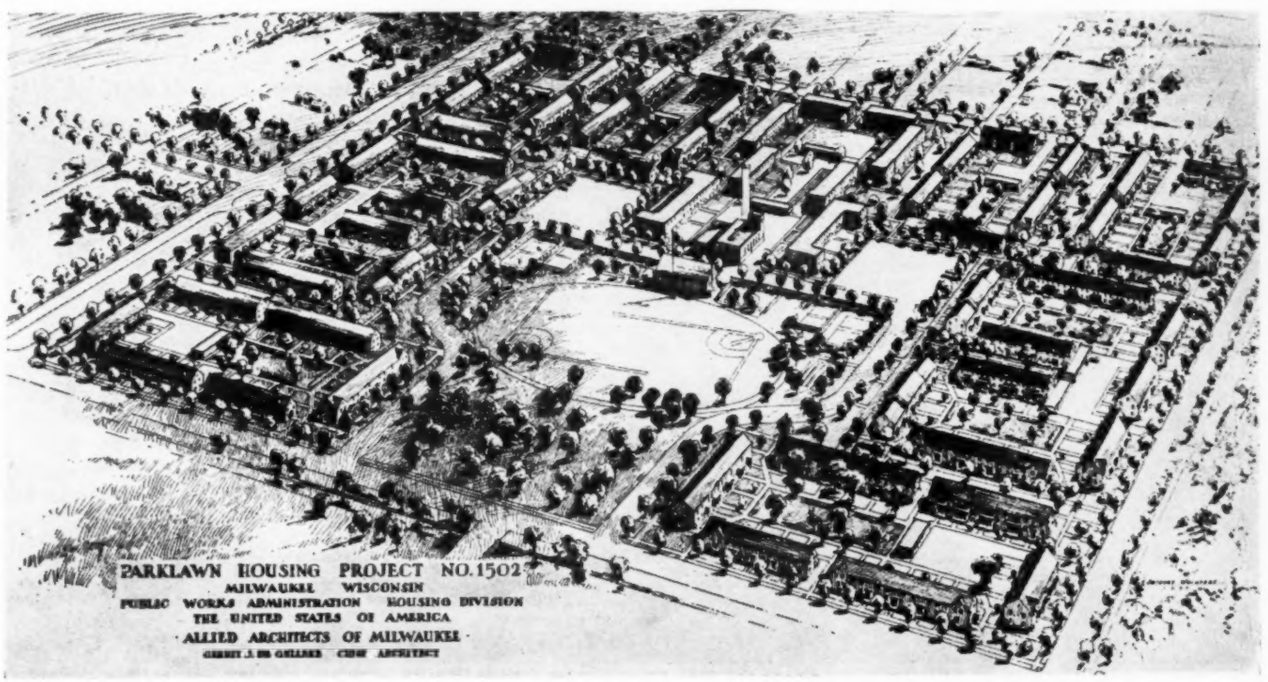
Each house or apartment will be equipped with electric stove and refrigerator. Four hundred and six living units in row houses comprise the bulk of the development. The largest of these rows comprises 10 homes, the smallest 5. The living units are of various sizes, with 1, 2 or 3 bedrooms, the 2-bedroom type comprising about 70 per cent of the total. In addition to these houses, there are 8 apartment buildings with a total of 112 single-bedroom apartments.

Row houses are one and two stories high, while the apartments are two stories, the former being without basements. Foundations will be of concrete block, walls of tile with brick facing, all floors and ceilings of reinforced concrete: roofs of the houses will have interlocking tile on wood sheeting and rafters, while the apartment roofs, which are flat, will be of reinforced concrete. Garages will be provided for about 14 per cent of the homes. If this proves inadequate more can be added later, but in any case the service yards will afford parking space for all who may wish to use them.

Cost and Financing

Parkway Drive and the park and playground surrounded by it will be constructed and maintained by the city of Milwaukee. All the rest of the project including the community house located in the park, is being developed by the Housing Division of the Public Works Administration.

The land was acquired at a cost slightly less than $90,000. A construction contract covering the complete project except landscaping, refrigerators and a few other items of equipment, the park, and Parkway Drive, was signed December 18, 1935, with the George A. Fuller Company of Chicago for $2,238,360. Work was started April 9 and it is expected that the contract will be finished before the end of the present year.


PARKLAWN HOUSING PROJECT NO. 1502
MILWAUKEE WISCONSIN
PUBLIC WORKS ADMINISTRATION HOUSING DIVISION
THE UNITED STATES OF AMERICA
ALLIED ARCHITECTS OF MILWAUKEE

PARKLAWN
Architect's Perspective of the Project. Looking Southeasterly.

PARKLAWN
Concrete Box Culvert to Carry Creek in Forty-seventh Street.

In financing the project the Federal government advanced the full cost, 45 per cent of which will be an outright grant, and the remainder amortized over a 60-year period. The very substantial character of the construction is necessitated by this long amortization period, quite independently of its other advantages.

The Housing Division of P. W. A. will retain supervision of maintenance and operation of the property. Tenant selection will be made in cooperation with the Milwaukee Advisory Committee.

History

The history of Parklawn is interesting—particularly in its relation to slum conditions and clearance.

While Milwaukee has an enviable reputation for good housing, it is unfortunately not entirely free from slums. Accordingly, when PWA funds became available, plans were considered for clearing one of these areas and erecting modern, sanitary dwellings. The Milwaukee Planning Commission, however, in a broad and careful study found that a low rent housing project on the city's outskirts, would do more to alleviate bad housing than would any slum clearance operation. Available houses were already well filled, employment was increasing, and it was clear that as families "undoubled" after the prolonged consolidations of the depression, Milwaukee would be in greater need than ever of decent low-rent houses. Estimates indicated that while the slum land which it was proposed to clear would cost about $1.00 per square foot, good outlying vacant property could be got for approximately $0.05 per square foot. Not only could much more good housing be provided for a given price in the outskirts than in the present slum location, but the living environment would be distinctly better—especially for children—and the project could be located nearer to major industrial districts.

PARKLAWN
Concrete Block Foundations.

A carefully worked-out report by the Planning Commission of the city convinced the Federal authorities on this point, and the appropriation was made for Parklawn accordingly—one of the first cases in which PWA housing funds were granted for other than slum clearance projects. Although by this time the project was known to everybody, the 42 acres was purchased from 15 different holders at a price below its appraised value.

The accompanying pictures give a general idea of the status of work on the development on May 26th. Several hundred men were

PARKLAWN
The fertile black top soil, from 8 to 10 inches deep was stripped and stored in the pile here shown. When all construction is completed it will be re-spread for lawns and gardens.

PARKLAWN

The Contractor's Concrete Proportioning Plant. Rex Moto-Mixer on Ford Truck Is Leaving With a Batch for Floor Construction.

engaged at that time, and it is expected that as many as 3,000 may be employed at the height of construction activities.

The streets bounding Parklawn—one mile of them altogether—are now being improved by the Works Progress Administration. This work is neither organically nor financially a part of the Parklawn project. It includes grading, paving, water mains and sewers. A special feature is a 10-ft. by 6-ft. box culvert extending the full quarter-mile of the tract in 47th Street, to care for a creek which formerly flowed through the property.

Personnel

The work is carried out under the direction of the following: Hon. Harold L. Ickes, administrator of public works; Col. Horatio B. Hackett, assistant administrator of public works; A. R. Clas, director of housing; Wm. O. Krahn, district manager.

GREENDALE

SOME four miles south of the corporate limits of the city of Milwaukee, a new town is springing up in a manner reminiscent of boom days in the far West but under very different auspices and objectives.

This time it is Uncle Sam who has promoted and is carrying out the undertaking; and the object, instead of quick riches, is to show how good homes in wholesome surroundings can be provided for workmen with small incomes. The project, known as "Greendale," is the outcome of careful studies and planning by the Division of Suburban Resettlement of the Federal Resettlement Administration, which body also is doing the construction. When completed, it will be turned over to a holding corporation as trustee, which corporation will administer it according to the original intent, but will pay taxes and otherwise meet the objections to direct Federal ownership and operation.

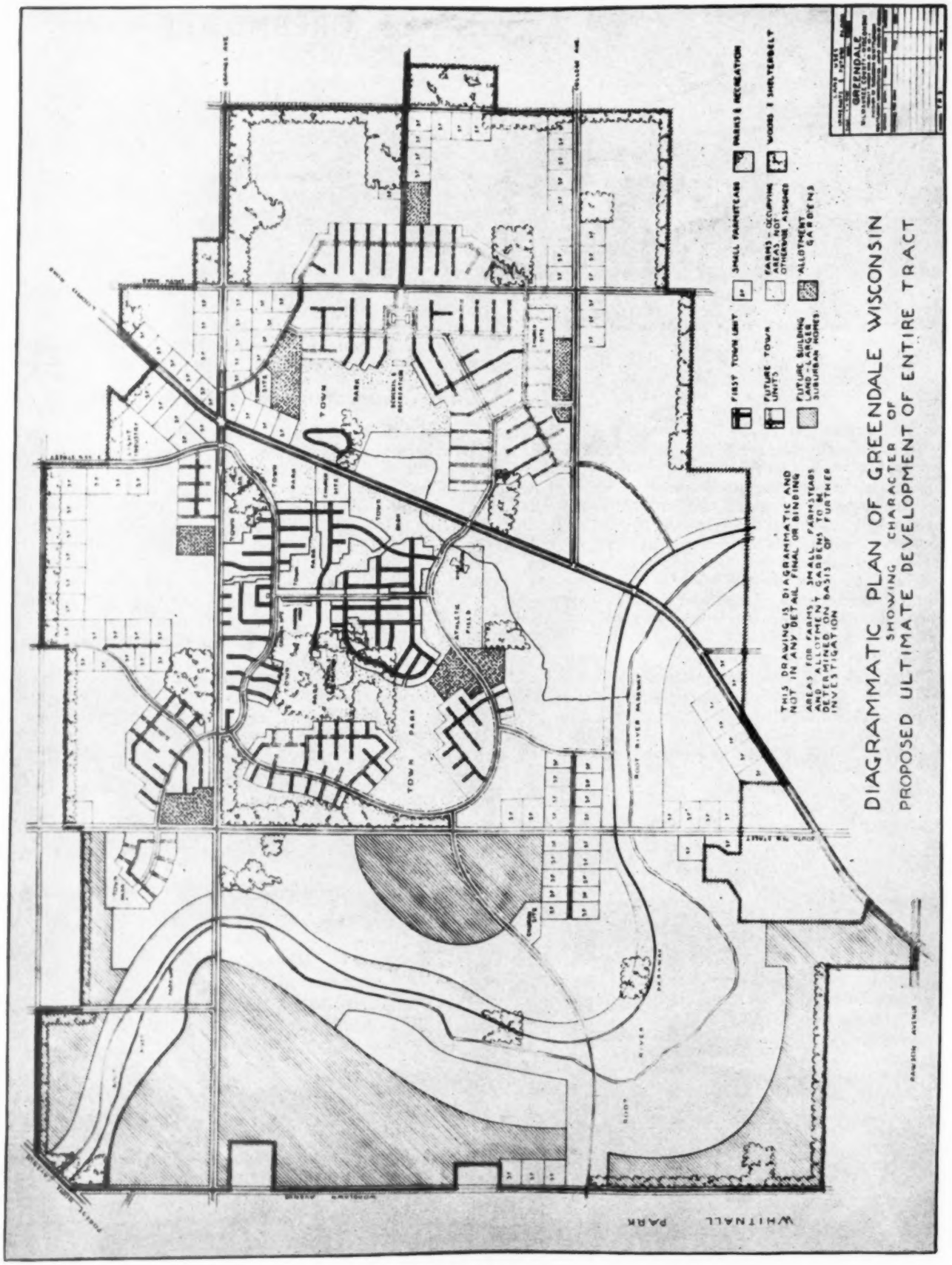
Site; Topography; Adjacent Industry

Three thousand five hundred and eleven acres have now been purchased or optioned in connection with the undertaking. This seems like a large area for the 750 families that will comprise the village, and so it is; but the reasons for it are several. In the first place, it affords protection against objectionable developments which would inevitably spring up near the settlement if given an opportunity; secondly, it provides a surrounding green belt of wooded land affording an ideal environment especially for children; and third, it provides room for several more developments similar to Greendale if such developments shall seem desirable in the future.

The acquired area is compact in shape and free from holes. In other words, there are no privately owned tracts surrounded by the project. Property purchases were made quietly before their purpose or the Government's interest were generally known, with the result

GREENDALE

View Looking Northeasterly from Observation Tower, May 25. Teams working in background, Trackson shovels at left center and extreme right—the latter working on North Road west of Broad St.—grader idle in foreground


DIAGRAMMATIC PLAN OF GREENDALE WISCONSIN
SHOWING CHARACTER OF
PROPOSED ULTIMATE DEVELOPMENT OF ENTIRE TRACT
FIRST TOWN UNIT
SMALL FARMSTEADS
PARKS & RECREATION
FUTURE TOWN UNITS
FARMS - OCCUPYING AREAS NOT ASSIGNED OTHERWISE
WOODS & SHELTERBELT
FUTURE BUILDING AREAS FOR SUBURBAN HOMES
ALLOTMENT GARDENS
THIS DRAWING IS DIAGRAMMATIC AND NOT IN ANY DETAIL FINAL OR BINDING
AREAS FOR FARMS SMALL FARMSTEADS AND OTHER ITEMS TO BE DETERMINED ON BASIS OF FURTHER INVESTIGATION
TOWN PARK
WHITNALL PARK

GREENDALE

General Plan of the Project

The Village of Greendale is located near center of the area. Broad Street is the straight North and South thoroughfare connecting the irregular curves of North Road and South Road

(North is to the left on this page.)

GREENDALE
Grading North Road. Trackson Shovel Loading Reo Speed Wagon

that although a few owners held out for high prices, the property as a whole was acquired at a cost which the authorities consider very reasonable. It is interesting to note that several times in the past this property was proposed for suburban development and that on each such occasion it took on a considerable speculative value.

The topography is of ideal rolling character giving good drainage and an interesting landscape without excessive grades for streets or roads. It contains extensive wooded areas as well as open fields and farm lands. There is a difference of 70 ft. in elevation between the highest and the lowest points.

Dale Creek flows through the tract in a general southerly direction, and Broad street is located in its valley, a few hundred feet west of the creek bed. This permits the location of important parts of the town on land sloping gently down to the main thoroughfare or axis. The creek channel will be deepened and widened to avoid danger of overflow in freshet.

In connection with the topography, it is worth noting that through the use of a one-foot contour map the entire street location was worked out in the office.

The business center of Milwaukee lies about 9 miles to the northwest of the town, and is accessible by 3 paved highways. The important West Allis manufacturing district is 4½ miles due north, while Cudahy with its meat packing industry and South Milwaukee with its large factories are about 5 miles east, all reached by good roads. Smaller manufacturing and business districts are accessible at various distances.

Houses; Tenants; Administration

The town site, comprising some 150 acres inclusive of interior parks and playgrounds, is nowhere nearer than ½ mile to the tract boundary. When occupied, it will be incorporated as a village. A strip of land on both sides of Root River traversing the entire tract will be set aside for park purposes and will be deeded to the County Park Commission for maintenance. This strip of land embraces an area of approximately 500 acres. The regional plan of the County Park Commission contemplated the use of Root River Valley for a park and park drive and the Resettlement Administration, by planning in conformity with the plan of the Commission, has enabled the latter's plans to be advanced by many years.

GREENDALE
Looking Easterly toward Observation Tower. McCormick-Deering Tractor with Bulldozer Grading Park Site in foreground

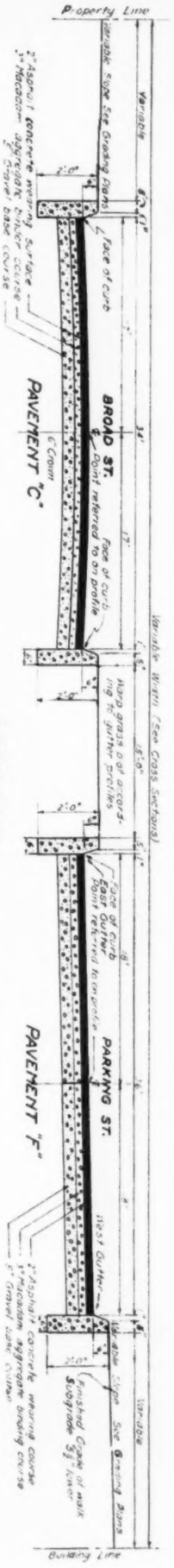
Tenants will be selected from families within a limited income range, not yet definitely decided but probably from about $1,000 to $1,800 per year. The management division of the Resettlement Administration will make the selections from among applicants. There seems little doubt that there will be a rush to get in, some 2250 favorable replies having been received on a questionnaire distributed in the southern Milwaukee area.

About 490 of the homes (65 per cent of the total) will be single family dwellings, while the remaining 260 will be in group houses holding 3, 4 and 6 families each.

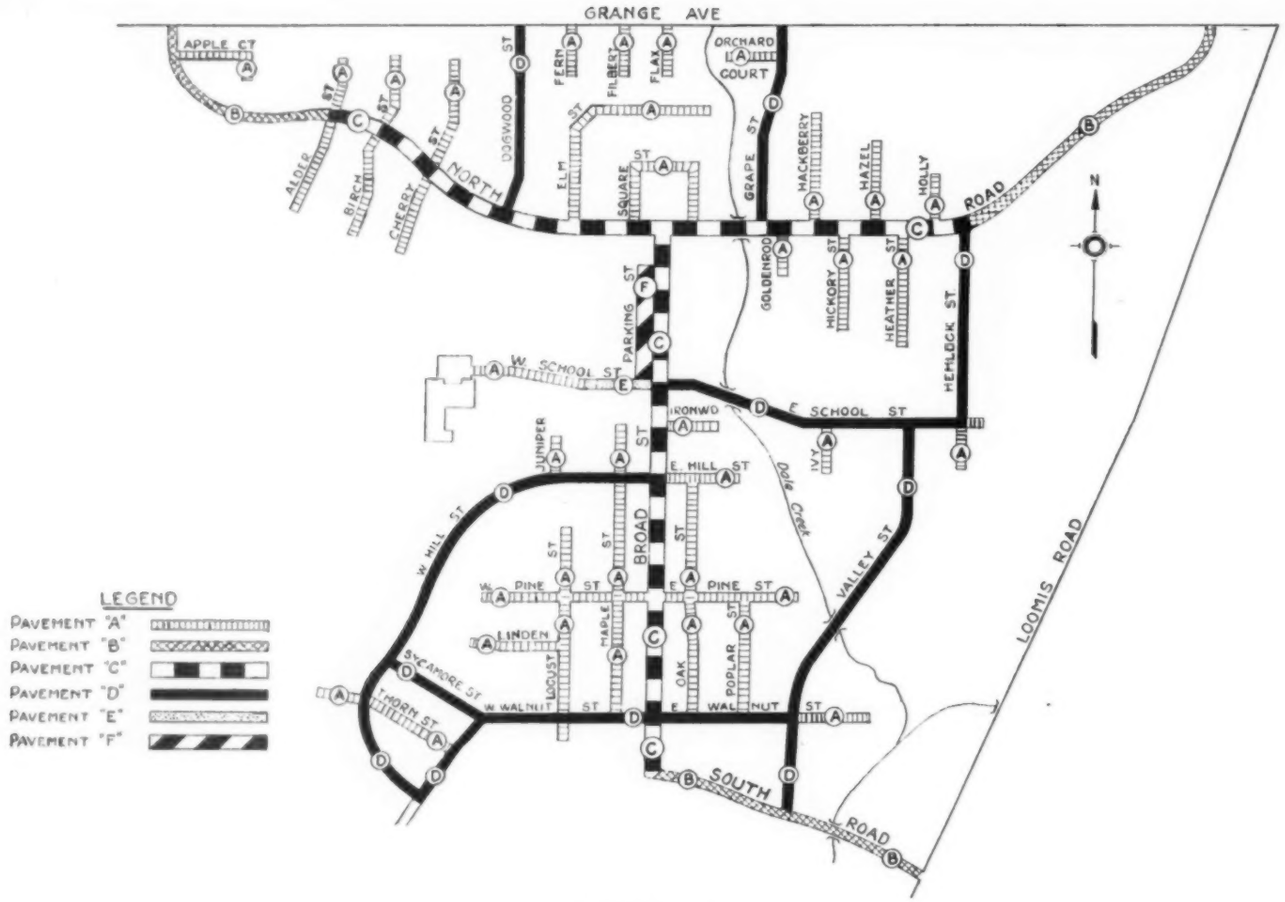
The smallest house will contain 3 rooms and bath—the largest 6 rooms and bath. There will be no dining room but all kitchens will be large. Each will be equipped with electric range and refrigerator. Heating will be with coal furnaces. Eighty per cent of the units have garages. Construction will be concrete blocks in varying designs. The average cost per house is expected to be about $4,000 for construction and fixed equipment. Land, grading, paving, water supply, sewerage and public buildings will be additional.

Lots for detached houses will measure about 50 by 100 ft. Group houses will have lots 100 ft. deep in most cases, with a minimum width of 30 ft. for the smallest units. Vegetable gardens at a moderate distance from the settlement will be provided for all tenants who may want them.

Rental rates have not yet been determined. Preliminary



GREENDALE
Typical Section for Double Pavement at Business Area



GREENDALE
Location Plan Showing Distribution of Various Pavement Types

studies indicate that the cost of operation and maintenance will amount to approximately $4.00 per room. To this must be added interest and amortization charges.

Public buildings will include retail stores, administration building, educational buildings for both children and adults, community house and library. Sites are available for churches, but these, of course, must be financed by the denominations or congregations establishing them. A swimming pool is among the park features. Adequate fire and police protection will be provided.

Street Plan; Pavements and Walks

The 3 primary roads—North Road and South Road, each roughly describing an arc through the village, and Broad Street connecting them on a north and south line—will have a total length of 2¼ miles. Pavement of North Road and Broad Street will be 34 ft. wide with a 6 in. crown, and will consist of a 5 in. gravel base, a 3 in. binder course, and a 2 in. cold asphalt surface. There will be 6 in. concrete curbs on each side. Curb faces will be 6 in. and total depth 24 in. Maximum grade is set at 5½ per cent and minimum at ½ per cent.

North Road will have a sidewalk on one side only, Broad Street on one side or both (decision still pending), and South Road perhaps none at all. All primary road sidewalks will be of concrete. The blocks on Broad Street are about 500 ft. long.

There will be about 4¾ miles of secondary roads, chiefiy of the dead end, or cul de sac, type. Those which are open at both ends are so located as to avoid through traffic. No cul de sac is more than 460 ft. deep.

All secondaries will have 18 ft. pavements, crowned 3 in. and built with a 7½ in. gravel base and 2½ bituminous top. Curbs will be the same as for primary roads. A 4 ft. or 4½ ft. bituminous walk will be provided on the side most naturally used in going to and from the business center. The maximum grade will be about 7½ per cent and the minimum ½ per cent as on primary roads.

Construction

All work is to be done by force account, using relief labor, which fact will, unfortunately, greatly increase the cost. All machine operators are paid the union scale, while common labor gets the security wage fixed by the WPA. Most of the equipment is rented, though some government-owned trucks are in service.

On May 25th, when the writer visited the job, there were 2 Trackson shovels, one Galion grader, and one McCormick-Deering tractor with bulldozer at work. Along with these were a number of horsce-drawn slip scrapers and No. 2 wheelers. Horse-drawn wagons were also in service along with motor trucks, and the picture in general showed an interesting combination of the old and the new in grading methods.

An excellent construction camp and office have been established, a material spur 2½ miles long has been

built into the property from the nearby electric road, and work is being pushed rapidly.

Grading for roads and buildings was begun about May 10th. All top soil is carefully stripped and stored in piles at locations designated on the plans so as not to impede other work. Subsoil is mostly gravelly formation, with clay in spots.

The property contains several excellent deposits of gravel for road-building and other purposes. There is enough oversize material to warrant consideration of a crusher installation.

Water will be obtained from 2 wells, located on different parts of the tract, and yielding about 2000 g. p. m. each. As all ground water in this region is very hard, a softening plant will be necessary. Distribution will be by gravity from an elevated tank, through 12 in. and 8 in. cast iron mains.

Cost of Project

The entire project is estimated to cost $7,000,000 including overhead. Of this total, about $1,300,000 is for the 3511 acres of land, but as indicated on the plan large portions of the area will probably be used later for other settlements.

During the construction period a maximum of 3,000 men will be employed.

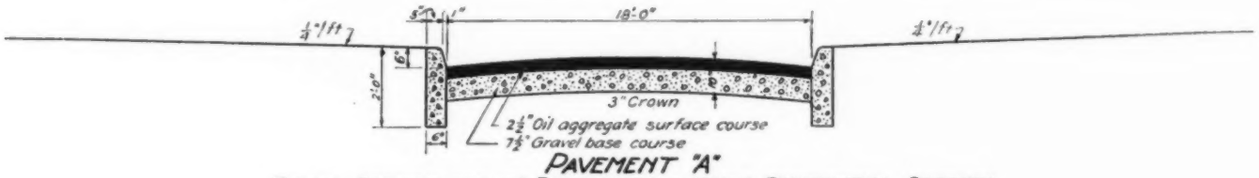
Personnel

The heads and staff in charge of this work are as follows:

Rexford G. Tugwell, Administrator; R. A.

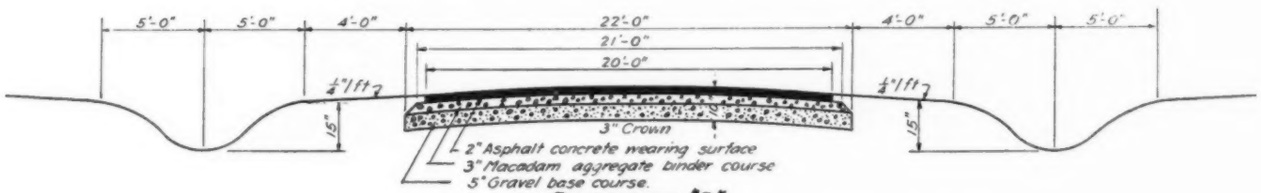
John S. Lansill, Asst. Administrator R. A. and Director of the Division of Suburban Resettlement.

Frederick Bigger, Chief of Staff.



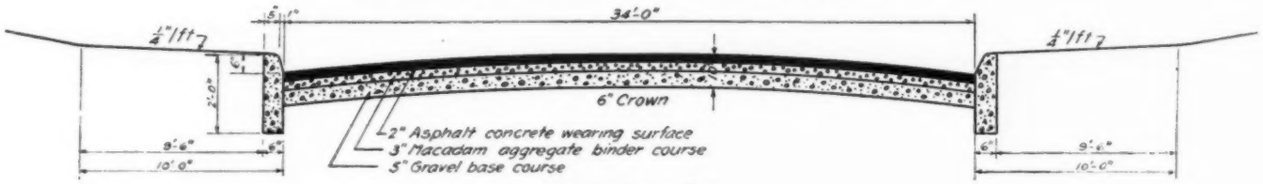
PAVEMENT "A"

TYPICAL SECTION FOR 18' PAVEMENT ON MINOR RESIDENTIAL STREETS



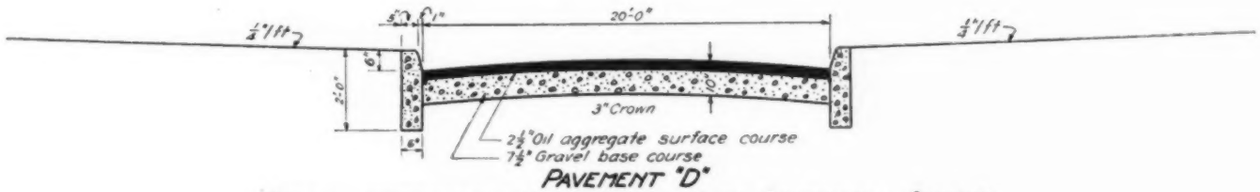
PAVEMENT "B"

TYPICAL SECTION FOR 20' PAVEMENT ON PRINCIPAL TRAFFIC STREETS
(See plan and profile of North Road for detail of banked section)



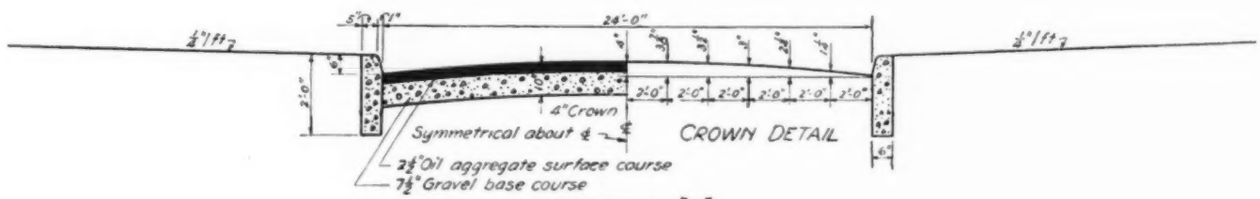
PAVEMENT "C"

TYPICAL SECTION FOR 34' PAVEMENT ON PRINCIPAL TRAFFIC STREETS



PAVEMENT "D"

TYPICAL SECTION FOR 20' PAVEMENT ON MAJOR RESIDENTIAL STREETS



PAVEMENT "E"

TYPICAL SECTION FOR 24' PAVEMENT ON SPECIAL WIDTH STREETS

GREENDALE

Standard Pavement Sections

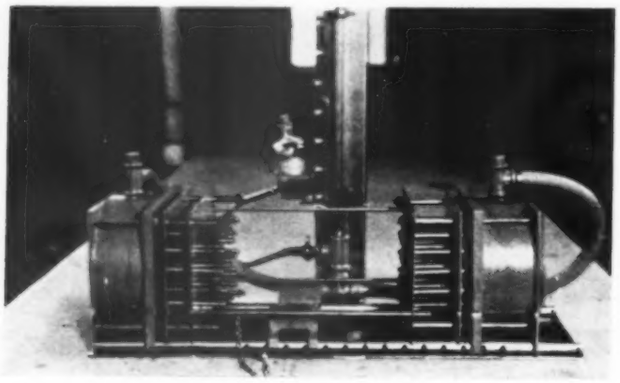
Frank Schmitt, Director of Construction Div.
Fred L. Naumer, Coordinator.
Elbert Peets, Principal Town Planner.
Jacob Crane, Principal Town Planner.
Walter Thomas, Principal Architect.
Harry H. Bentley, Principal Architect.
Grover Adams, Resident Engineer.

▼

Device Measures Core Thickness

A device which accurately calibrates the depth of cores from concrete pavements is being used in connection with tests by a number of Boroughs in New York City. The device determines the average thickness of cores instantly and accurately.

It consists of two barrel-like cylinders mounted so that the right cylinder may be moved towards the stationary left cylinder. Twenty-five steel rods, which move in and out with ease, project from each base. These rods are well distributed within an area of a 6 in. circle to measure a core of approximately 6 in. The barrels contain a heavy oil, on top of which is alcohol. This alcohol is guided through a tube from each barrel to a single gauge glass that is calibrated in fractions of an inch.



Instrument for Measuring Thickness of Cores

To measure a core the right barrel is first brought to rest against a pin which has been placed in a hole marked zero in the rectangular base. The liquid in the gauge is also brought to zero. After this calibration, the right barrel is returned to its first position and the core is inserted between the barrels with one end against the pins in the left barrel. The right barrel is then moved toward the core until all pins are in contact with the surface of the core. As pin is forced into the barrels, displaced liquid is forced into the gauge glass, from which a reading is made.

The device is said to check the same core measurement to within one or two hundredths of an inch, regardless of the irregularity of the ends of the cores. It will measure cores of cylinders from 0 to 14 in. in from one to two minutes.

This equipment was developed by Walter G. Doherty, Chemist in the Laboratory of the Borough President of the Bronx, New York, N. Y.

▼

STABILIZED SOIL ROADS.—A technical report entitled "Stabilized Soil Roads" has been issued recently by the U. S. Bureau of Public Roads, Washington, D. C. The report is prepared for use by engineers and summarizes results of field and laboratory research. It is not a manual of instructions for construction of low-type roads.

More Gasoline Used in 1935 —Taxes Yielded $619,000,000

Gasoline consumption by motor vehicles in 1935 increased 6.4 per cent over the preceding year and state taxes yielded a revenue of $619,000,000 according to statistics collected by the U. S. Bureau of Public Roads. Every state reported increased consumption, the largest increase being 13.4 per cent in New Mexico. Increases of more than 10 per cent are reported for Alabama, Arizona, California, Georgia, Idaho, New Mexico, North Carolina, Oklahoma, Oregon, South Carolina, and Utah.

The average tax rate was 3.8 cents. Gasoline consumed on highways amounted to over 16 billion gallons. This figure includes some non-highway consumption in 13 states that do not allow refunds of the tax for non-highway use. During the year the tax rate was increased by one cent in Connecticut, Delaware, Nebraska, New York, and Pennsylvania.

Details concerning state taxes on gasoline are as follows:

Tax Rate at End of Year Cents	Net Receipts*	Approx. Amount Used on Highways, Gals.	States
6	$ 10,313,112	172,474,000	Alabama
5	3,278,598	67,323,000	Arizona
6.5	8,261,907	131,784,000	Arkansas
3	39,983,955	1,340,137,000	California
4	6,009,533	152,324,000	Colorado
3	5,671,844	263,781,000	Connecticut
4	1,481,819	42,948,000	Delaware
7	17,896,972	256,609,000	Florida
6	15,771,723	264,617,000	Georgia
5	3,124,297	63,743,000	Idaho
3	30,385,382	1,015,019,000	Illinois
4	19,262,319	472,010,000	Indiana
3	11,549,118	386,489,000	Iowa
3	8,961,190	295,308,000	Kansas
5	9,835,918	201,324,000	Kentucky
5	9,416,969	186,201,000	Louisiana
4	4,572,827	114,532,000	Maine
4	8,278,025	204,850,000	Maryland
3	17,334,090	584,233,000	Massachusetts
3	22,790,561	767,987,000	Michigan
3	11,362,258	374,701,000	Minnesota
6	7,512,370	123,291,000	Mississippi
2	9,845,301	498,350,000	Missouri
5	3,844,542	77,393,000	Montana
5	9,808,734	219,165,000	Nebraska
4	962,040	24,046,000	Nevada
4	2,868,166	71,992,000	N. Hampshire
3	18,205,102	594,432,000	New Jersey
5	2,877,605	57,987,000	New Mexico
4	56,311,245	1,495,863,000	New York
6	19,147,015	305,579,000	N. Carolina
3	2,323,387	78,877,000	N. Dakota
4	39,169,151	965,240,000	Ohio
4	11,877,151	299,593,000	Oklahoma
5	7,942,853	160,434,000	Oregon
4	40,708,840	1,171,439,000	Pennsylvania
2	2,106,204	106,133,000	Rhode Island
6	8,584,144	143,014,000	S. Carolina
4	4,315,419	97,415,000	S. Dakota
7	14,966,016	216,386,000	Tennessee
4	33,606,085	835,942,000	Texas
4	2,714,341	69,396,000	Utah
4	2,048,645	51,388,000	Vermont
5	13,340,505	272,169,000	Virginia
5	12,568,379	252,601,000	Washington
4	6,102,941	153,105,000	West Virginia
4	16,249,747	405,909,000	Wisconsin
4	1,931,912	47,445,000	Wyoming
2	2,197,209	111,983,000	Dist. Columbia
3.8	$619,677,466	16,264,961,000	Total

*Includes receipts from dealers' licenses, inspection fees and miscellaneous items.

TOUGH TIRE JOBS LICKED

This Goodrich-equipped portable shovel is stripping dirt and loose rock from a limestone deposit in Illinois.

HOW NEW GOODRICH SILVERTOWNS SET RECORDS on CONSTRUCTION JOBS

● Now you can get a tire built especially to stand up on the toughest hauling jobs in the construction industry. It's the new Triple Protected Silvertown—the tire that ends worries about sidewall breaks.

In most truck tires the sidewall is the weak spot—80% of the premature failures occur right there. So Goodrich built a tire with Triple Protection at the "Failure Zone." This invention makes the tire just as strong in the sidewall as it is under the tread. The yanking, twisting, flexing action that ruins many tires is positively checked by Triple Protection!

Don't Take Chances

One tire failure on an important job may cost you hours of delay—men and equipment idle—a big repair bill. Why not play safe? Get the only tire that has this 3-way protection:

1. PLYFLEX—distributes stresses throughout the tire—prevents ply separation—checks local weakness.

2. PLY-LOCK—protects the tire from breaks caused by short plies tearing loose above the bead.

3. 100% FULL-FLOATING CORD—eliminates cross cords from *all* plies—reduces heat in the tire 12%.

Talk to a Goodrich dealer. Ask him to show you the tire that shrinks costs and stretches mileages. There's no premium price to pay.

For information on any tire problem write The B. F. Goodrich Co., Akron, Ohio.

Ray Beseker, driver for the Laura Gravel and Stone Co., Phillipsburg, Ohio, says, "I've driven trucks for 15 years but I've never seen tires that stand up like these new Silvertowns."

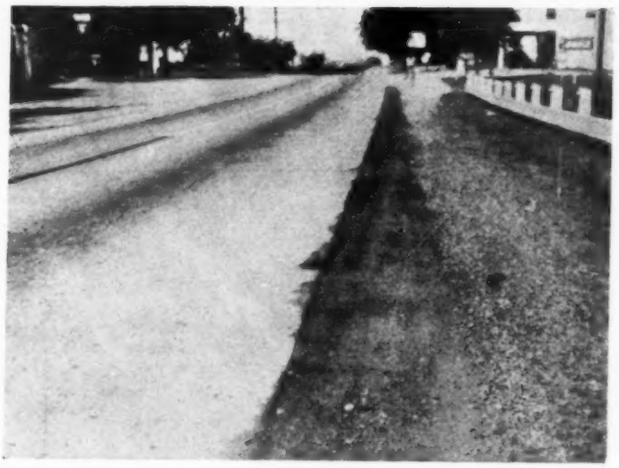
Hauling bricks means heavy loads. This Indiana contractor uses Goodrich Silvertowns exclusively.

Up and over goes this Continental Wagon Scraper. Triple Protected Silvertowns carry the load through any kind of soil.

Goodrich *Triple Protected* **Silvertowns**

SPECIFY THESE NEW SILVERTOWN TIRES FOR TRUCKS AND BUSES

Yes—We would like you to mention ROADS AND STREETS



Stabilized Pavement Shoulder on U. S. Route No. 3, Fayette County, Ohio

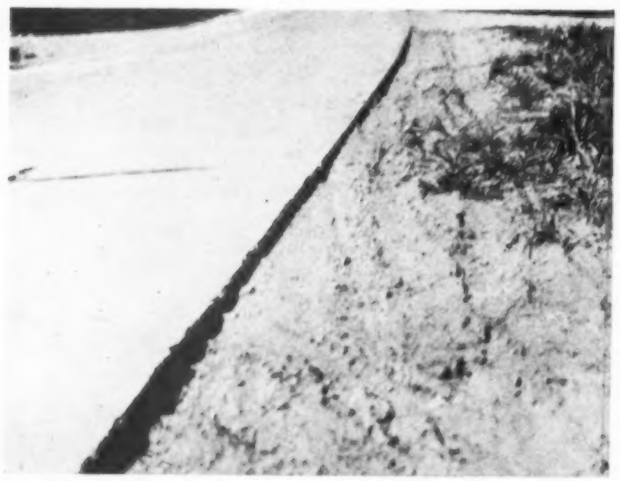
SHOULDER STABILIZATION: AN EFFECTIVE HIGHWAY SAFETY MEASURE

By B. C. TINEY

Chief Engineer, Calcium Chloride Association.

MAINTAINING the shoulders along heavily traveled roads is one of the real problems to be met by highway maintenance organizations. This is especially true on roads where the hard surfacing is only of 2-lane width and the shoulder soil is of such nature as to readily soften and become unstable in wet weather. Loose sandy shoulders, too, become very troublesome in dry weather.

When heavy vehicles run off the edge of the pavement, either accidentally or to park for emergency repairs, they often cut a deep rut along the edge of the pavement slab. Unless this rut is repaired at once it constitutes a serious traffic hazard. Numerous serious accidents are on record as caused by drivers running into such shoulder-ruts and losing control of their cars.



Shoulder Hazard, Not only a Trap for Moving Cars Forced Off the Pavement, But Inadequate to Support Vehicle Load When Roadside Parking Is Necessary

Water collecting in these depressions soaks under the edge of the pavement, making the subgrade unstable and eventually resulting in damage to the pavement.

This constant shoulder maintenance may be greatly minimized by placing, for a width of 2 to 3 feet on each side of the pavement, a low-cost material having sufficient bearing power to resist the occasional traffic that runs on the shoulder.

A stabilized mixture of gravel, crushed stone or slag, containing enough sand or similar fines to fill the voids and enough binder-soil and moisture to give cohesion, is ideal for this purpose. An admixture of flake calcium chloride at the rate of 18 lbs. per cu. yd. with a light surface application of this chemical made to the finished shoulder, will aid in quick compaction and keep the mixture in a stable and dustless condition through dry weather periods.

When thoroughly compacted, shoulders which have been stabilized in the above described manner will resist rutting in wet weather, and if the shoulder has proper slope, very little storm water will penetrate into it. The presence of this layer of semi-impervious material on the shoulder will thus prevent any appreciable amount of water from seeping down and weakening the subgrade under the edge of the pavement.

The construction of stabilized shoulders involves the excavation of the existing shoulder to a depth of 4 to 6 in. and a width of 2½ to 3 ft. At least part of this work may be done with power grader equipment. The excavated earth may be hauled away or bladed out to widen the shoulder.

If the soil in the existing shoulders has suitable binding or cohesive qualities, the proper amount of it may be incorporated with the aggregates as binder-soil.

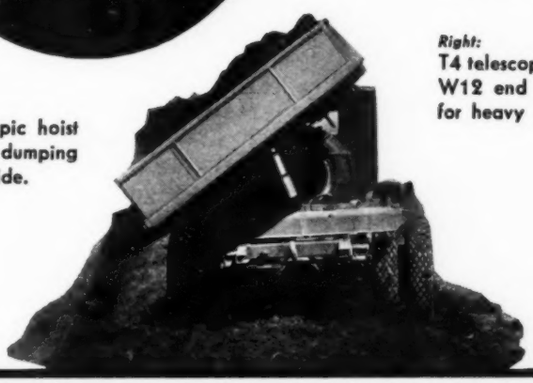
GAR WOOD HOISTS AND BODIES

for ROAD BUILDING and MAINTENANCE

Left:
D6 Hoist—C12 Body
1½ cu. yd. unit
for light duty trucks.

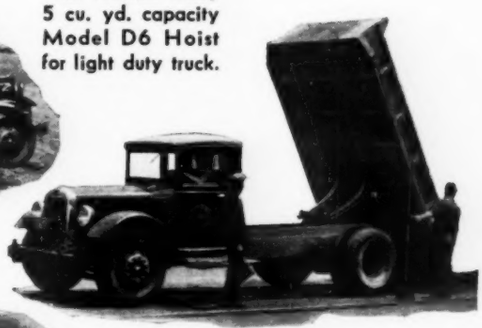
Right:
T4 telescopic hoist and
W12 end dump body
for heavy duty trucks.

Right:
T2 telescopic hoist
with body dumping
to either side.



for STREET and ALLEY SERVICE

Left:
C4R rubbish body
5 cu. yd. capacity
Model D6 Hoist
for light duty truck.



Above:
Model M5 mechanical hoist provides
70° dumping angle—ideal for han-
dling "hot stuff."

Left:
Special trailer dump body equipped
with dual cylinder underbody tele-
scopic hoist Model T33.

GAR WOOD INDUSTRIES, INC.

DETROIT, MICHIGAN

WORLD'S LARGEST MANUFACTURER OF TRUCK EQUIPMENT

Bituminous Mat Widened and Butted to Prevent Edges from Raveling by Calcium Chloride Stabilized Shouldering on Wayne County Road, Michigan

Combining of the aggregates, binder-soil, calcium chloride and water may be done by blade-mixing them together prior to excavating the shoulder. If the shoulder is of fair width, this operation might be carried on without overlapping on the pavement to the extent of any serious interference with traffic. The completed mixture could then be windrowed on the edge of the pavement and scraped into the trench as fast as the latter is prepared.

A method involving less disturbance of traffic, however, would be to prepare the stabilized material at a central mixing plant and haul the completed product to the prepared trench. A more uniform mixture would be obtained. Compaction of the mixture as placed (being off the traveled way) is highly important and can be best accomplished by rolling it with truck-wheels or by using a 3-wheeled roller.

Stabilized shoulders can be kept in smooth condition by blading them three or four times per year, following rains sufficiently heavy to make the surface slightly plastic. This operation will also aid in maintaining a proper slope for shedding storm water. If casual surface pockets occur they should be patched with a stabilized mixture similar to that used in the original construction. Two or three surface applications of flake calcium chloride per year, at the rate of ½ lb. per square yard, will maintain the shoulders in a damp and bonded condition and eliminate dust.

Highway officials throughout the country are giving more and more attention to the problem of increasing safety on our roads. The construction of more stable shoulders is a vital point in this connection and deserves the careful attention of the men who are responsible for maintaining safe highways.

▼

Cost of Graveling and Oiling Shoulders, New York State, 1935

The State of New York, Department of Public Works, Division of Highways reports that in the year 1935 departmental forces graveled and oiled 90,276 sq. yd. of shoulders at a cost of $7,941, or 8.8c per sq. yd. The average depth of gravel was 3 in. Bituminous material was applied at the rate of ½ gal. per sq. yd. The cost is exclusive of overhead.

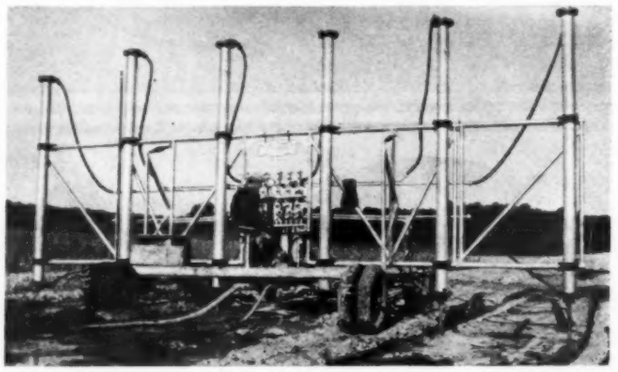
One-Man Jetting Machine

A jetting machine for consolidating new fills, now in operation on a highway job near St. Louis, Mo., is so designed that one operator controls all the jets.

The machine can be towed to the job with a Ford truck. It requires three men about two hours to set it up ready for operation, excluding water supply facilities. This requires only to change the alignment of the four pneumatic tired dual wheels and swing the outside jets into position. Then the only thing necessary is to connect a 2-in. hose to the water line and the jetting operations can begin.

S. Roy Blackwell

In jetting, the operator first forces a jet down into the fill immediately to a depth of approximately 18 in., then raises it to 12 in. and then adjusts the pressure so that it goes down at a rate which allows the embankment to absorb the water thereby reducing to a minimum waste or excess water. After all jets are set the operator has only to watch his gauges and make necessary adjustments to secure the desired saturation. In order to secure good results the water must be introduced slowly at comparatively low pressure and at a rate that permits the embankment to absorb the water to complete saturation.



Jetting Machine at Work on Fill Near St. Louis, Mo.

By means of the extension jets the lower strata can be just as thoroughly and economically saturated as the upper layers and it requires only a minute of the laborers' time to place the extension on the jets.

The machine was invented by S. Roy Blackwell of the Blackwell Corporation, General Contractors, East St. Louis, Ill. The illustration shows jetting operations in a fill near St. Louis, Mo., for the contract of M. E. Gilloys.

▼

WINTER WEATHER AND FLOOD DAMAGES TO ROADS AND BRIDGES—The replacement cost for damages to state highways due to the severe winter weather and floods in the period December 1, 1935, to April 1, 1936, amounted to $50,832,050, according to *American Highways*. Of this total, costs amounting to $12,474,100 were due to the floods. The damages to bridges amounted to $12,895,500, 911 structures being involved.

BE SURE WITH STABILIZATION

LEFT—*Route 124, Indiana. Thin bituminous mat after seven months on stabilized base, in good condition after spring break-up.*

ABOVE—*Route 124, Indiana. Calcium-chloride-stabilized surface ten months after construction.*

A CHAIN is as strong as its weakest link—and a road as strong as its foundation.

During the past few years, it has become increasingly evident that a high-type surface should never be built on a weak base.

Stabilization with calcium chloride provides a base course of greatly increased supporting value, on which a high-type surface can be placed with confidence. That's why prominent engineers the country over are stabilizing their roads as the first step to permanent improvement.

While stabilized roads make better bases for higher type surfaces, do not assume that additional surfacing is always essential. A stabilized road is, in itself an enduring, all-weather, dustless highway—in most cases ample for traffic needs and decidedly more economical.

Thousands of miles of stabilized roads are now in use and functioning perfectly under traffic with no other surface than the natural soil mortars produced by the stabilization process. Where extremely high traffic counts or especially heavy loads are carried, you need only to add the higher type hard surfaces necessary to carry them.

TECHNICAL BULLETINS

Free Be sure with stabilization. Write today for technical bulletins and literature based on latest findings of soil engineers.

CALCIUM CHLORIDE ASSOCIATION

THE COLUMBIA ALKALI CORPORATION.....Barberton, Ohio
THE DOW CHEMICAL COMPANY.....Midland, Michigan
MICHIGAN ALKALI COMPANY.....60 E. 42nd St., New York City
SOLVAY SALES CORPORATION.....40 Rector St., New York City

NO MATTER WHAT FUTURE SURFACE "STABILIZE FIRST"

CALCIUM CHLORIDE

FOR STABILIZING ROAD SURFACES

MASSACHUSETTS: BIRTH PLACE OF SCIENTIFIC HIGHWAY ENGINEERING

By W. W. CROSBY**

Consulting Engineer, Coronado, Calif.; Formerly Chief Engineer State Roads Commission of Maryland

ENGINEERING EDUCATION seems at times to be inclined toward too much cultivation of the art of constructing physical conceptions—like a trade school—and to tend to neglecting the broader cultural foundation, which includes history, economics, and even psychology. If this is so, then engineers of today, and of tomorrow, may well devote a few moments' attention even to personal memoirs of those who are reaching that stage when shades of the past appear to be impressive. A decent regard for history is a characteristic of educated maturity. Highway engineering is now certainly reaching "Man's Stature." Its cultural development should not be neglected.

About three years ago, one of our most prominent technical publishers appealed fervidly and widely for pressure on Congress to appropriate funds for the U. S. Bureau of Public Roads. In that appeal he gave credit to the federal bureau for all that may be found to be good in modern highway engineering in this country. He disregarded the facts that the Federal Aid law was not passed until 1916; that, in the 20 years and more preceding, the foundations had been "well and truly laid" by some states—as the efforts of the U. S. Office of Public Roads were almost wholly "propaganda" prior to the enactment of Federal Aid; and that even since 1916 many of the developments in highway engineering have been initiated or cultivated in the state highway departments independently of the federal bureau.

Correspondence with the publisher revealed that he knew the facts, but he asked that, if in his appeal, he had "seemed to stress unduly the importance of this (federal) contribution," . . . "please attribute it only to my zeal as an advocate" . . . "making the strongest case that I can for my clients, so to speak."

It is regrettable that, even in an "emergency," such a source should suggest to the younger generation of highway engineers a partial or distorted view of the facts of history. Naturally one cannot see exactly for another. But when one, because of his eminence or farsightedness may be expected to relate his view accurately and dependably for the benefit of those less fortunately situated, the obligation certainly lies on him to make every effort to avoid deception in his statements.

The Cradle of Highway Work.—Mecklenburg County, North Carolina, has been generally credited with being the "cradle of highway work in America." Its law of 1879 was probably the first successful organized effort to get away from an old theory that the abutting property was solely responsible for the condition of the public right-of-way past that property. By co-operation, by sincere effort on broader lines, and by the use of convict labor, i.e., effective outside aid, the county made remarkable progress in road improvement for several years after the date mentioned.

But, if Mecklenburg County was the "cradle," the state of Massachusetts, and particularly William E. McClintock—the moving spirit and, later, Chairman of the Massachusetts Highway Commission from 1894 to 1908—has earned the title of "Father of Modern Road Improvement" in these United States.

Massachusetts Enacts First Effective State Aid Law.—Massachusetts enacted the first really effective State-Aid to highways law in 1893. The first appropriation (available in 1894) was $300,000. The Commissioners appointed were: George S. Perkins* (Chairman), William E. McClintock*, and Prof. N. S. Shaler*. In 1897 the appropriation had risen to $800,000 annually. By 1899 some 206 miles of improved (macadam) roadway had been completed at an average cost of $10,000 per mile.

It is true that a similar law had been enacted by New Jersey in 1891 with an appropriation of $20,000, but, due to some technicalities, work under that law did not begin until a year or more later. The New Jersey appropriations were much smaller than in Massachusetts, so that by 1899 New Jersey had completed only 120 miles (mostly of gravel) at an average cost of about $4,000 per mile.

Connecticut entered the State-Aid group in 1895 with an appropriation of $75,000, and New York State, in 1898, with $50,000, but their results were not more than locally important up to 1899 when Dr. Harry Fielding Reid*, of the Maryland Geological Survey, in the "First Report on the Highways of Maryland" (p. 357), made the following statement: "Too much cannot be said in commendation of the work of the Massachusetts Highway Commission. No state or commission in this country has done so much to improve the methods of road construction, and to make clear the advantages of a proper selection of road material, in order that the road should be both satisfactory and economical."

Personnel of Massachusetts Highway Commission.—The organization of the Massachusetts Highway Commission (1893-1901) included the following:

Commissioners—George S. Perkins*, Chairman; Wm. E. McClintock*, and Prof. N. S. Shaler*.
Chief Engineer—Charles Mills* (1894-1901) and A. W. Dean (1910-1935).
Secretary—A. B. Fletcher* (1893-1909).
Asst. Sec'y—Miss Mary A. Riley (1893, to date, and now Secretary).
1st Assistant Engineer—J. S. C. Taber* (1896-1899).
2nd Assistant Engineer—A. M. Lovis* (1896-1922).
3rd Assistant Engineer—A. N. Johnson (1894-1898).
Geologist in charge of Tests—Logan Waller Page* (1894-1900).
Division Engineers—W. R. Farrington* (1896-1920), F. H. Joyner* (1898-1912), F. C. Pillsbury (1896-

**Mr. Crosby was resident engineer, Massachusetts Highway Commission, 1897-1901.—Ed.)

*Now deceased.

You wouldn't buy a ROLLER piecemeal

Why split up your purchases of ROAD STEEL?

BETHLEHEM PRODUCTS FOR HIGHWAY BUILDING

•

BAR MATS
WELDED WIRE FABRIC
CONTRACTION JOINTS
(Road Strip)
EXPANSION JOINTS
STEEL REINFORCING BARS
MISCELLANEOUS PRODUCTS
DOWELS, DOWEL BAR
SUPPORTS, BAR TIES, ETC.
THE KALGUARD
(Steel Highway Guard)
BETHLEHEM STEEL SHEET PILING
BETHLEHEM STEEL H-PILING

You'd laugh at any contractor who bought his road rollers part by part and wasted weeks assembling them because some part failed to arrive when needed. Your common sense tells you that's a mighty inefficient way of doing business.

But just a moment. Did you ever stop to realize the needless loss of valuable time and inconvenience that result from similar methods of buying road steel? When purchases of road steel are split up extra expense and delay are almost certain.

And nobody knows better than you do that delay means money out of your pocket. That's why so many contractors throughout the country are concentrating their orders for road steel with one central source of supply—Bethlehem Steel Company.

Bethlehem is equipped to supply the principal forms of steel used in concrete road building. Each order, regardless of its size or the geographic location of the job, is coordinated and treated as a single unit. This coordination means that shipping dates can be planned according to the requirements of the particular job. When you use the Bethlehem Road Steel Service every item of road steel you order, from reinforcing bars to highway guards, is on hand when you need it.

Bear this in mind before starting on your next road contract. 'Phone or wire the nearest Bethlehem district office for detailed information on the complete Bethlehem Road Steel Service.

BETHLEHEM STEEL COMPANY
GENERAL OFFICES: BETHLEHEM, PA.

BETHLEHEM STEEL

Bethlehem District Offices are located at Albany, Atlanta, Baltimore, Boston, Bridgeport, Buffalo, Chicago, Cincinnati, Cleveland, Dallas, Detroit, Hartford, Honolulu, Houston, Indianapolis, Kansas City, Los Angeles, Milwaukee, New York, Philadelphia, Pittsburgh, Portland, Ore., Salt Lake City, San Antonio, San Francisco, St. Louis, St. Paul, Seattle, Syracuse, Washington, Wilkes-Barre, York. *Export Distributor:* Bethlehem Steel Export Corporation, New York.

1936), W. B. Wheeler (1896-1906), J. A. Johnston (1897-1936).

McClintock: A Pioneer of Scientific Road Building.—In August, 1900, Mr. McClintock succeeded Mr. Perkins as Chairman, and the other Commissioners named were Harold Parker* and John H. Manning*.

Mr. McClintock had fully assimilated the principles of McAdam and most of the new Massachusetts roads were built of that type. He insisted on the use of only good stone, broken to proper sizes, and free from clayey or similar material that would hold water in excess. He established tests for determining the value or suitability of the available rocks of the State. The so-called "Rattler Test" was imported from France where, as the "Deval Test" it had been shown at the Paris Exposition in 1878. At Mr. McClintock's suggestion Page supplemented the rattler test of the stone with one of the "dust" from that test for securing information as to the cementing ability of the material in the road surface.

Mr. McClintock also suggested some theories regarding the relation of the sizes of particles in the sub-grade to the capacity of the latter for absorbing and holding moisture. He used the first reinforced concrete for covering highway culverts; the first use of cotton cloth in road-building was made at his instance on Nantucket; he developed a practical theory as to the distribution of loads through the macadam to the sub-grade; he was first to suggest and to use the replacement of fine material on the surface of macadam roads as a means of combatting the destructive effects of automobiles; he made the first scientific efforts to build bituminous surfaces "mixed-in-place," to mention only some of the highway practices still in nation-wide use now.

The form of highway contract and many of its clauses and specifications served as models (or *verbatim*) for many other States for years afterward, as did the tests of materials. The annual reports of the Massachusetts Highway Commission for these years furnished—and may still serve as such—unmatchable text-books for highway engineers.

Massachusetts: A Training School for Highway Engineers.—The Massachusetts Highway Commission developed men as well as methods for supplying the awakening demands of other States. Porto Rico needed an experienced road engineer, applied to Massachusetts, and Louis J. Proctor was sent there in 1900. Similarly, Maryland secured A. N. Johnson for her investigatory work that same year. In 1900, L. W. Page* went to the U. S. Office of Public Roads to take charge of the laboratory work for Director Martin Dodge*. Baltimore County secured W. W. Crosby in 1901, and in 1905 he took charge of the State-Aid construction of Maryland, Johnson going to the U. S. Office of Public Roads and later to the State of Illinois as State Highway Engineer. Charles M. Upham went from the Massachusetts Testing Laboratory in 1911 to establish the laboratory of the "DuPont Road" and later to become Chief Engineer of it. F. H. Joyner* went to the Highway Engineership of Los Angeles County, California, in 1911. A. B. Fletcher* went to San Diego County, California, in 1910 and became State Highway Engineer of California in 1912. F. E. Everett went from Resident Engineer, Massachusetts Highway Commission, in 1907 to New Hampshire as State Highway Engineer. And there were undoubtedly many other instances not now recalled by the writer where Massachusetts-trained men influenced directly the work in other states.

The writer can cite a few cases, "in the second degree, or generation," such as E. F. Ruggles, Resident Engineer, Massachusetts, becoming 1st Assistant Engineer, Maryland Highway Commission, going later to the U. S. Bureau of Public Roads; W. D. Uhler*, 2nd Assistant Engineer, Maryland, to State Highway Engineer of Pennsylvania; A. R. Hirst, Assistant Engineer, Maryland, to State Highway Engineer of Wisconsin; F. E. Schnepfe and R. Getty Browning, Resident Engineers, Maryland, to North Carolina; and several others to the counties of Maryland and even to other state or national organizations.

Some "Stayed Put" in Massachusetts, and the world has beaten "a path to their doors"! for the standards and results developed by the Massachusetts Highway Commission have received world-wide recognition and approval. Some died in harness, but their footprints may still be found "in the sands of time."

Mr. McClintock is gone. So are Fletcher, Farrington, Lovis, Joyner, Page, and many others from the original group and from among the later membership of this celebrated organization. The profession has profited from what they thought and said and did. Let its newcomers be taught to respect their memory!

Forty-Three Years' Continuous Service With the Commission.—While referring to personalities, let one more be mentioned here. Massachusetts still cherishes in active service a highway official who, in years of continuous service far out-ranks any in the country. Modest, efficient, faithful, dependable to the limit, the present secretary of the highway division of the Massachusetts Department of Public Works—Miss Mary A. Riley—has been "keeping things straight" in Massachusetts highway affairs for more than 40 years! It is impossible to evaluate and to express her influence in this connection.

The impersonal side of the Massachusetts influence on the results now evident on our highways is clearly shown in many ways to those familiar with road history. The Federal-Aid Act itself is modeled on the Massachusetts law. While the Massachusetts Highway Department has never been theatrical nor radical, and has at times seemed unduly conservative, it has steadily been progressive. Even nowadays it is often quietly "starting something" that eventually will spread nationally for the benefit of highway-users—such, for example, as the control of "Bill-Boards" and the protection of the roadsides.

Let a paraphrase of Daniel Webster's words in the U. S. Senate about a century ago furnish a closing of this article.

"I have entered on an encomium of Massachusetts; she needs none. There she is. Behold her and judge for yourselves. There is her history; the world should know it by heart. The past is at least secure."

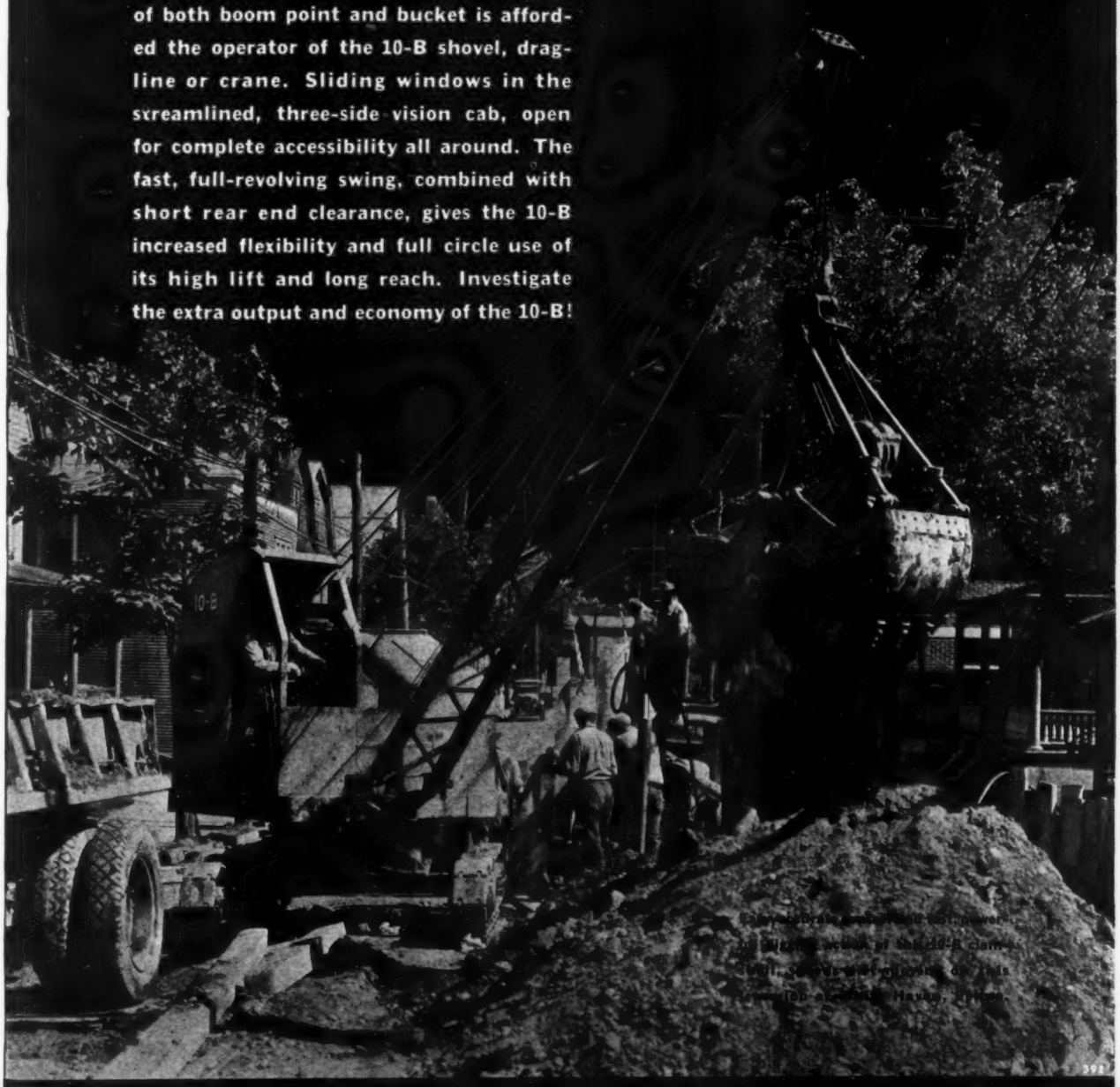
▼

ARGENTINE 5-YEAR HIGHWAY CONSTRUCTION PROGRAM—The President of Argentina has approved the plan as prepared by the National Highway Department, for the program of highway construction now being undertaken. The entire project calls for a total expenditure of 300,000,000 pesos, to be expended over a period of five years. The plan as recently approved also embraces the work which has been completed since 1934, in fact about half of the total appropriation has already been obligated by past and present highway construction. The remainder is to be spent during the remainder of this year, and in 1937 and 1938. It is anticipated that the Highway Department's program will be completed by the end of 1938, and that proceeds from the gasoline tax will more than cover the amount required.

BUCYRUS-ERIE

Full Visibility

of both boom point and bucket is afforded the operator of the 10-B shovel, dragline or crane. Sliding windows in the streamlined, three-side vision cab, open for complete accessibility all around. The fast, full-revolving swing, combined with short rear end clearance, gives the 10-B increased flexibility and full circle use of its high lift and long reach. Investigate the extra output and economy of the 10-B!



BUCYRUS ERIE

EXCAVATING, DRILLING, AND MATERIAL HANDLING EQUIPMENT... SOUTH MILWAUKEE, WISCONSIN, U. S. A.

Yes—We would like you to mention ROADS AND STREETS

HIGHWAY MAINTENANCE COSTS IN NEW YORK STATE

THE Division of Highways of the New York State Department of Public Works expended an average of $642.58 per mile for maintenance of its 12,306 miles of highways during the year 1935. Pavement maintenance alone cost $192.25 per mile, and other maintenance $450.33. These costs include overhead charges but exclude the costs of changes to better types. Corresponding costs for each of the 67 types of pavement in service appear in another table. Average annual maintenance for each principal type for each year from 1917 to date are also given.

Below are details of maintenance by departmental forces for the year 1935.

Quantity	Unit	Class of Work	Total Cost	Cost Per Unit
737.49	miles	*Surface treatment.....	$ 427,318.48	$579.42
6,085	miles	Pouring cracks and joints	153,309.18	25.19
12,476	miles	Maintenance to pavement only	1,445,798.24	115.89
		Total cost, pavement only	$2,026,425.90	
10,132	miles	Restoring and scraping shoulders and ditches.	$1,085,141.27	107.10
305,460	lin.ft.	Repairing guide rail (all types)	129,000.62	0.42
2,688,569	lin.ft.	Painting guide rail (all types)	93,494.77	.024
54,556	signs	Repaired and painted	223,941.30	
3,590	miles	Pavement zone marked		
4,106	miles	Sanding pavement	718,944.81	175.10
12,022	miles	Mowing R. O. W.....	519,021.40	43.17
		Miscellaneous repairs other than pavement.	116,102.38	
		Total cost other than pavement	$2,885,546.55	
		Summary	$4,911,972.45	
		Resurfacing, reconstruction, improvements and extraordinary repairs.....	2,339,061.41	
		Grand total	$7,251,033.86	

The above costs are exclusive of overhead.

*Surface treatment is divided into two classes, heavy and light. Heavy treatment consists of two applications totaling 0.8 gal. of bituminous material, each covered with a total of approximately 200 tons of cover material per mile (used mainly on concrete pavements). Light surface treatment consists of approximately 0.3 gal. of bituminous material with 60 tons cover material per mile.

Maintenance Cost by Types

The Division reports the number of miles of each type of surface maintained and the costs per mile for the year 1935 as in the accompanying table. These costs include overhead charges. Data indicated for certain types of pavement, where but a small mileage was maintained during the season, are entered in this table for record purposes only, and are not comparable with the other types on a yearly basis.

The fact that average width and cost per sq. yd. are not available only slightly lessens the value of the table, for except in extreme cases maintenance cost is more a function of length than of area.

Type of Pavement	Miles Maintained Excluding Change to More Permanent Type	Cost Per Mile — Pavt. Only Excluding Change to More Durable Type	Cost Per Mile — Pavt. Only Excluding Change to More Durable Type	Cost Per Mile — Other Than Pavement
Bit. mac. Pen. asphalt, mac. base	2,220.535	634.82	243.69	391.13
Bit. mac. Pen. tar binder, mac. base	185.11	751.32	401.62	349.70
Bit. mac. Pen. asphalt, conc. base	26.18	622.12	358.37	263.75
Bit. mac. Pen. tar, conc. base.	4.33	1,172.52	799.74	372.78
Bit. mac. Pen. type 2.....	23.96	316.19	34.10	282.09
Waterbound macadam, surface treated	743.60	954.43	497.69	456.74
Conc., 1st class, 2-lane.....	5,568.825	608.80	112.58	496.22
Conc., 1st class, 3-lane.....	682.07	740.29	127.53	612.76
Conc., 1st class, 4-lane.....	204.675	917.39	224.77	692.62
Concrete, 2nd class.....	34.07	631.09	353.15	277.94
Concrete Hassam	1.31	1,220.89	111.67	1,109.22
Brick pavement	147.625	492.44	305.20	187.24
Gravel	205.37	890.32	609.60	280.72
Topeka, conc. base.....	37.36	487.76	209.69	278.07
Topeka, mac. base.....	37.53	1,387.48	183.32	1,204.16
Bitulithic, conc. base.....	11.64	464.74	352.02	112.72
Willite, conc. base.....	2.60	916.62	211.89	704.73
Asphaltic conc., conc. base...	2.17	4,180.73	30.76	4,149.97
Asphaltic conc., mac. base....	0.65	711.69	221.62	490.07
Gravel mix, mac. base.....	5.05	786.93	645.35	141.58
B.M.M.M., type 2, conc. base.	26.87	390.88	102.37	288.51
B.M.M.M., type 2, mac. base..	19.73	325.47	136.83	188.64
B.M.M.M., type 3, conc. base.	342.785	440.22	132.05	308.17
B.M.M.M., type 3, mac. base..	324.325	518.58	135.99	382.59
B.M.M.M., type 3, brick base.	1.98	427.19	6.03	421.16
B.M.M.M., type 3, gravel base	0.62	0	0	0
B.M.M.M., type 5, conc. base.	27.30	434.93	142.23	292.70
B.M.M.M., type 5, mac. base..	57.35	762.69	338.99	423.70
B.M.M.M., type 5, brick base.	0.26	315.23	270.23	45.00
Open mix, conc. base (incl. cold patch)	32.37	863.95	218.24	645.71
Open mix, mac. base (incl. cold patch)	11.05	838.66	512.63	326.03
Stone block	2.83	259.71	94.93	164.78
Asphalt block, mac. base.....	1.46	480.14	182.88	297.26
Sub-base bituminous	0.75	51.71	.....	51.71
Bit. mac. layer method (incl. 3 and 4 layer).....	30.69	400.03	161.85	238.18
Kentucky rock asphalt.....	1.00	30.17	.....	30.17
Penolithic	1.29	182.04	138.22	43.82
Colprovia, mac. base.....	5.63	443.67	15.06	428.61
Colprovia, conc. base.....	1.815	431.96	0	431.96
Colprovia, brick base.....	0.23	960.43	414.78	545.65
Retread, conc. base.....	100.51	479.82	202.77	277.05
Retread, mac. base.....	915.245	461.28	190.31	270.97
Retread veneer, mac. base....	93.655	719.34	122.72	596.62
Retread veneer, conc. base....	1.64	3,110.37	1,784.76	1,325.61
Bituminous mulch, gravel....	.....	.....	.....	.....
Sheet asphalt and asphalt block	0.17	876.47	.....	876.47
Sheet asphalt, mac. base.....	1.66	189.52	54.00	135.52
2-strip dual, brick and conc...	10.23	933.10	633.46	299.64
2-strip dual, brick and W. B..	0.48	1,153.54	442.85	710.69
2-strip dual, conc. and Topeka	0	.....	.....	.....
2-strip dual, B. M. and M. M. 5	0.42	608.02	608.02	0
2-strip dual, brick and M. M. 3	2.01	554.26	45.85	508.41
2-strip dual, brick and gravel.	3.12	440.88	280.93	159.95

Where the going is the toughest—

Use AMSCO

Renewable Lip Dippers!

(U.S. Patent 1945064)

THEY ARE STRONGER—Redistribution of metal throughout the double wall body, base, and lips makes for greatest strength.

HAVE GREATER CAPACITY — Correct, smooth interior body design and proper location of corner teeth provide greater capacity in each dipper of given size.

A LONGER SERVICE LIFE — Being entirely of AMSCO Manganese Steel with all wearing parts easily and quickly renewable, the service life is greatly extended.

DIG FASTER — The sharp lip, and wide mouth, take a bigger bite, rolling the material into the center and providing for quicker filling. A large, fast, quick-opening door facilitates rapid dumping.

THEY'RE LIGHTER IN WEIGHT — New design makes for appreciably lighter weight without sacrificing strength, rigidity or long life.

AMSCO Renewable Lip Dippers are made for all makes and models of shovels — in sizes from ¾ yard up — with quickly interchangeable lips for mucking and clay handling, loose digging and stock piling, and tough digging and rock handling.

Your shovel manufacturer or our nearest office will gladly furnish complete details—write today for specifications and prices.

AMERICAN MANGANESE STEEL COMPANY

Division of American Brake Shoe & Foundry Company

406 East 14th Street, Chicago Heights, Ill.

Foundries at Chicago Heights, Ill.; New Castle, Del.; Denver, Colo.; Oakland, Calif.; Los Angeles, Calif. • Offices in Principal Cities

Type of Pavement	Miles Maintained	Cost Per Mile Total	Pavt. Only	Other Than Pavt.
2-strip dual, conc. and asphalt block	0.63	673.02	315.87	357.15
2-strip dual, conc. and B. M. M. M. 2	10.29	499.22	264.10	235.12
2-strip dual, conc. and B. M. M. M. 3	13.41	493.54	131.70	361.84
2-strip dual, conc. and B. M.	6.18	1,150.19	378.71	771.48
2-strip dual, conc. and spec. B. M. M. M.	2.67	1,127.72	279.40	848.32
2-strip dual, conc. and W. B.	2.07	758.79	676.74	82.05
2-strip dual, conc. and gravel	1.78	888.22	799.15	89.07
3-strip dual, brick and conc.	2.49	529.06	272.72	256.34
3-strip dual, brick, conc. M. M.	3.93	272.93	111.35	161.58
3-strip dual, conc. and B. M.	51.91	2,251.99	415.95	1,836.04
3-strip dual, conc. and W. B.	2.19	967.39	455.30	512.09
3-strip dual, conc. and M. M. 3	1.40	256.63	187.66	68.97
5-strip dual, conc. and B. M.	0.37	.....	.....	.....
Bit. bottom course	20.575	965.54	729.62	235.92
Earth	6.91	159.62	124.99	34.63
Total	12,306.34	642.58	192.25	450.33

Abbreviations: The letters M.M. in the preceding table mean "mixing method"—in general, "plant-mixed bituminous macadam."

B.M.M.M. means "bituminous macadam, mixing method," or "plant mix."

B.M. & M.M. means "bituminous macadam, penetration and bituminous macadam, mixing method."

All other abbreviations are believed to be generally known or self-explanatory.

Costs for 17 Years

The Division reports average annual maintenance costs of the principal types of surface during the past 17 years as in the table below. These costs include other maintenance as well as maintenance pertaining exclusively to pavement surfaces. They also include overhead charges. It is especially interesting to note the gradual increase in these costs throughout the first part of this period, the sudden jump in 1928, and the nearly uniform decline since that year. But in judging the real trend of maintenance costs, the steady improvement in the quality of maintenance throughout this period must be borne in mind. Many conditions which were accepted without complaint in 1917 would not be tolerated today. Increased width of roadway must also be considered.

AVERAGE ANNUAL MAINTENANCE COSTS PER MILE OF PRINCIPAL TYPES OF SURFACE IN NEW YORK STATE—1919-1935

	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	Averages for 17 yrs.
Bit. mac. Pen. method, asphalt and tar	501	590	753	613	794	845	1,017	927	1,180	1,047	1,229	1,103	1,179	825	750	844	644	896
Topeka on conc. base	144	335	229	365	332	545	597	727	620	779	603	514	706	486	308	285	488	495
Topeka on mac. base	443	985	769	730	855	1,370	1,411	1,229	1,306	1,361	1,427	1,196	1,232	1,033	819	1,101	1,387	1,138
Waterbound	694	797	951	776	897	914	1,000	1,059	1,137	1,281	1,181	1,187	1,012	1,090	898	1,079	954	1,013
Brick	247	242	307	303	350	424	564	730	629	738	1,162	759	738	603	712	582	492	583
1st cl. conc., 2 lane only	214	227	225	225	218	333	410	487	613	575	587	707	642	423	523	441	609	453
2nd cl. conc	761	868	874	691	729	1,079	1,141	1,044	1,528	1,259	1,143	1,354	1,156	1,035	854	1,029	631	1,026
Gravel	771	704	890	739	814	1,187	1,619	888	1,204	1,304	1,296	1,036	832	918	876	909	890	1,007
Averages of all types	560	631	744	607	712	757	860	830	823	1,122	1,078	982	876	634	638	624	653	786

36 States Survey Highways as Basis for Road Programs

Highway planning surveys are now in progress or soon will begin in 36 states, according to the U. S. Bureau of Public Roads. The surveys are being conducted by the state highway departments with the cooperation of the Bureau. They will supply information to put future highway improvement on a sound, business-like basis.

In the past attention has been centered on improving the main through highways. In the future more attention must be given, highway officials say, to improving secondary and feeder roads and to improving conditions where the main highways pour their traffic into cities. At the same time the main highways must be maintained and further improved to meet needs that already exist, particularly as regards safety.

Federal highway officials who are coordinating the various state surveys think that a selection should be made of those roads that because of their importance merit early consideration in an improvement program. Future programs can be planned intelligently only with information as to which roads should be improved first. To determine this highway officials need definite facts as to traffic counts, construction costs, maintenance costs, how much taxes that can be fairly imposed for highway use, and where the taxes should be imposed from the viewpoint of highway usage.

Information along these lines is being collected in each of the state surveys. Each survey has three branches—a highway condition survey, a highway traffic survey, and a highway finance survey.

Highway transportation is now one of the major industries of the country. Its future development, says the bureau, should proceed according to a plan covering a period of years, and based on economic and social needs.

Survey work is under way in:

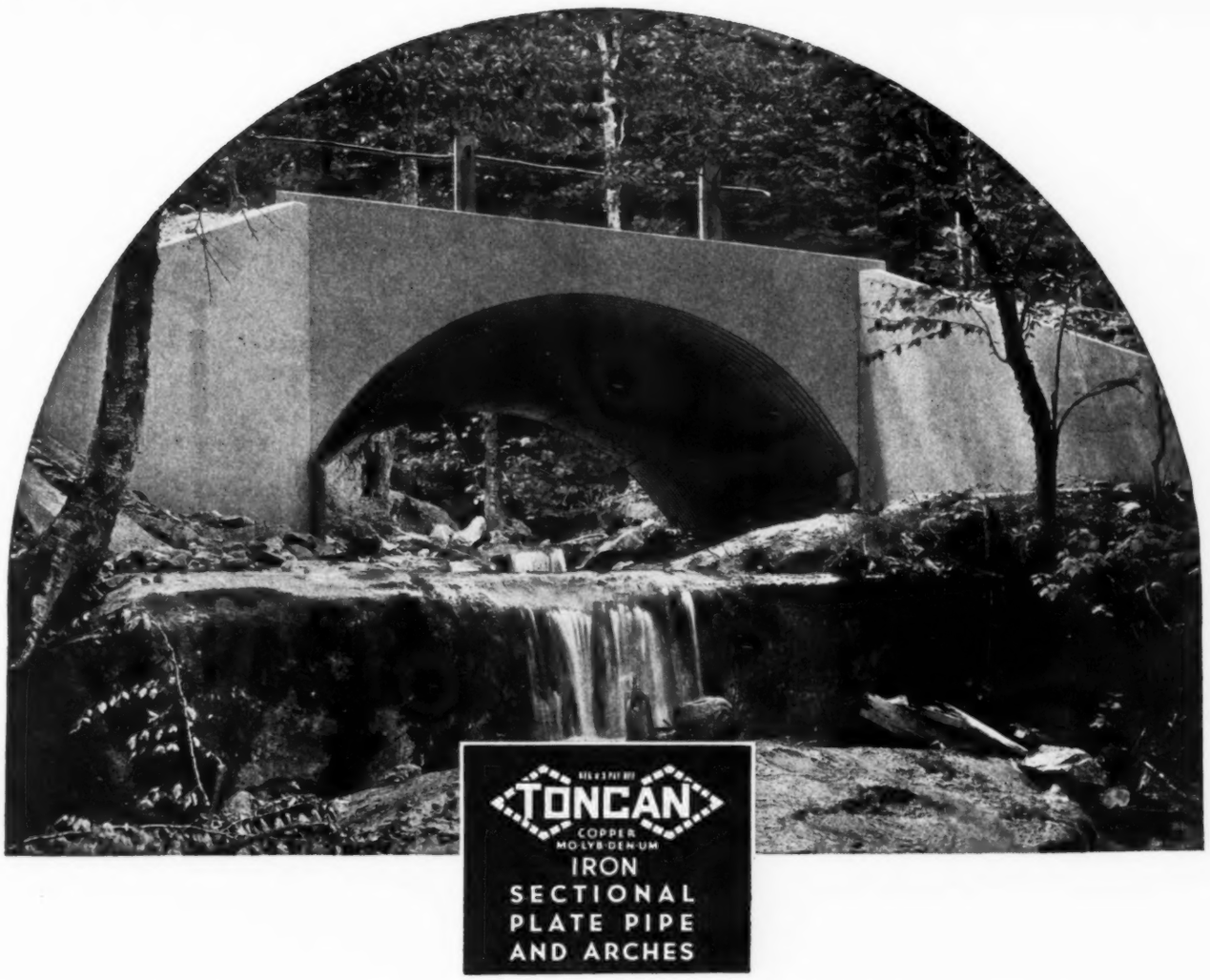
Washington	New Mexico	Wisconsin
Oregon	Nebraska	Illinois
Nevada	Kansas	Michigan
Idaho	Oklahoma	Indiana
Utah	Minnesota	Ohio
Arizona	Iowa	Pennsylvania
Montana	Missouri	Florida
Wyoming	Arkansas	North Dakota
Colorado	Louisiana	Virginia

Surveys will begin soon in:

California, South Dakota, Texas, Alabama, West Virginia, and Tennessee.

The following additional states have indicated a desire to conduct surveys:

Kentucky, North Carolina and South Carolina.



LONG-LASTING BRIDGES THAT BEAUTIFY

● Engineers, highway officials and all those connected with building smaller bridges, are taking pride in making installations that appeal to the eye. These men know that in using **TONCAN SECTIONAL PLATE PIPE OR ARCHES**, they get structures that are easily adaptable to the immediate surroundings, as well as being economical in first cost, and requiring little maintenance. Let the nearest Toncan fabricator show you how to build Long-Lasting Bridges that Beautify, with Toncan Sectional Plate Pipe and Arches.

TONCAN CULVERT MANUFACTURERS' ASSOCIATION

REPUBLIC BUILDING **CLEVELAND, OHIO**

Beall Pipe & Tank Corp. . . Portland, Oregon
Berger Metal Culvert Co. of N. E., Boston, Mass.
Bluegrass Pipe & Culvert Co. . . Louisville, Ky.
Central Culvert Company . . Alexandria, La.
Dominion Metal & Culvert Corp., Roanoke, Va.
Eastern Culvert Corp. . . . . Philadelphia, Pa.
A. N. Eaton Metal Products . Omaha, Nebraska
A. N. Eaton Metal Products Co., Billings, Mont.
Eaton Culvert Co. . . Grand Island, Nebraska
Empire State Culvert Corporation, Groton, N. Y.
Illinois Corrugated Culvert Co. . . Peoria, Ill.
Jensen Bridge and Supply Co. . Sandusky, Mich.
H. V. Johnston Culvert Co., Minneapolis, Minn.
H. V. Johnston Culvert Co. . . Aberdeen, S. D.
Wm. E. Newman & Sons Co. . . Ogden, Utah
Republic Steel Corporation, Canton Culvert Division . . . . . Canton, Ohio
Thompson Mfg. Co. . . . Denver, Colorado
Toncan Culvert Mfrs. Assn., Cleveland, O.
Tri-State Culvert Mfg. Co. . . . Memphis, Tenn.
Tri-State Culvert & Pipe Co. . . . Atlanta, Ga.
Truscon Steel Co., Indiana Culvert Division . . . . . Indianapolis, Indiana
Western Pipe & Steel Co. . . . Los Angeles and San Francisco, Calif.
Wisconsin Culvert Co. . . . . Madison, Wis.
Wyatt Metal & Boiler Works . . . . . Houston and Dallas, Texas

TONCAN IRON ✣ A PRODUCT OF REPUBLIC STEEL CORPORATION

GEODETIC CONTROL FOR HIGHWAY SURVEYS

By J. C. CARPENTER
Senior Highway Engineer
U. S. Bureau of Public Roads

HIGHWAY surveys, as now made, are planned and executed with sufficient accuracy, commensurate with their cost, to serve the primary purpose of a control for construction procedure for a particular project or route. The idea that they may be utilized for any further service has never been given any very serious thought.

Cost of Surveys and Plans.—It would be difficult to determine, with any degree of accuracy, the total annual expenditure for highway surveys and the preparation of plans for the entire United States, and such a total would not be of any particular value. For the ordinary high-type surfaced road, surveys and plans may conservatively be estimated to cost as a minimum, 2 per cent of the construction cost. On a $600,000,000 program, it is safe to say that the cost of surveys and plans will be at least $12,000,000. After the projects are constructed there is very little value remaining for this expenditure for surveys. Plans are filed away until the roadway type becomes obsolete and reconstruction becomes necessary. When this time arrives, the old plans are resurrected and an attempt is made to use them as the basis for new work. Usually it is found necessary to make an entirely new survey.

With the general adoption of long-time planning, highway locations will become more stable and this will create a demand for better and more dependable surveys. Our profession should assume the leadership in planning, not only for the purely engineering phases but of the economic, fiscal and all related activities for the development of the country. The fundamentals of any plan must be fixed and permanent, but there must be a reasonable amount of flexibility, for planning is a continuing process and not a formula.

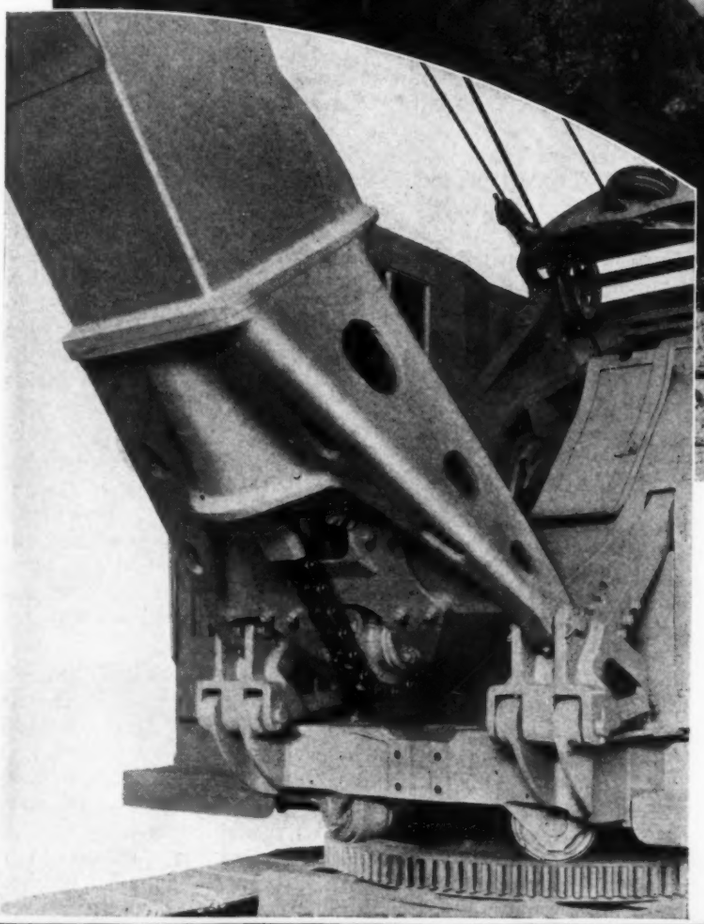
Geodetic Surveys as Controls.—The adoption of the United States Coast and Geodetic Survey network of Primary Triangulation as a control for all surveys and mapping is undoubtedly a fundamental in the process of planning, for it insures an absolutely dependable basis for all work and provides for continuing utilization of all previous expenditures. The ideal plan for a highway system would be one designed to serve all future traffic with the ultimate of economy in transportation costs. Locations, once established, would never be changed. Provision for adequate right-of-way for all future needs, would be arranged. Construction would be completed to care for the present traffic, but maximum salvage value would be obtained when increased traffic required a change in type. No one individual or group of individuals can hope to possess the wide vision or foresight necessary to lay out such an ideal plan, but engineers are best qualified in any planning movement designed to realize this ideal. This argument leads to the conclusion that our work should be as nearly permanent as is reasonably possible and the idea of permanency should logically begin with the highway survey.

Accuracy a Requirement of All Good Surveys.—The degree of accuracy is usually determined by the relative cost of the proposed improvement. An earth graded road is not considered to require the high precision necessary for an expensive high type pavement. But the total cost of a survey, assuming that skilful direction is employed is not greatly increased through careful attention to accuracy. The adoption of the method of Geodetic Control for highway surveys will not materially increase the cost, and it is entirely probable that after survey crews are properly trained the cost of surveys may be reduced. Even if there were a material increase in cost, the asset of permanent information gained for use in future work, the stabilization of land boundaries and increased accuracy would be many times more valuable than this increase.

Triangulation Network Now Available for All Surveys.—The past three or four years have brought about a change in the status of the U. S. Coast and Geodetic Survey Triangulation network that will allow its use for all types of surveys, and this availability means that our methods should be changed to take advantage of the immensely valuable datum thus established. In the period from April 30, 1934, to May 31, 1935, the total mileage of primary triangulation in the United States was increased from 43,572 to 60,032. It is estimated that 116,400 miles will be required to bring the spacing of acres to 25 miles. The utilization of the primary triangulation as a basis for all surveys is now a comparatively simple and easy procedure and engineers expending public funds should consider it their duty to the public to thoroughly investigate the possibilities and if reasonably practicable to use the valuable instrument to the fullest extent. Highway engineers, particularly, have an opportunity to render a signal service to the public by taking the lead in the adoption of Geodetic Control for surveys. The public highway mileage of the United States is 3,000,000 miles, or one mile to each square mile of area. It is not anticipated that Geodetic control can be established for every mile of public highway, but for the major highways that reach all important parts of the country, such control is possible and entirely practicable. The main highways may be assumed to cover about four hundred thousand miles, or one mile to each seven of area, the U. S. Coast and Geodetic Surveys network of 116,400 miles or one to each 26 of area, indicating a spacing about four times as wide as the main highways. These are average figures and may be criticized for covering too much territory, but they do, nevertheless, give a relative idea of the comparative spacing of the two systems and thereby indicate that the task of extending Geodetic control to highway surveys is not insurmountable.

The Texas network of Primary Triangulation of the United States Coast and Geodetic Survey includes 6,900 miles, which is approximately one-quarter of the state highway mileage, agreeing with the ratio set forth above.

KOEHRING



KOEHRING HEAVY DUTY

THE KOEHRING CHAIN CROWD

— is a single continuous chain traveling *inside* of the high strength welded boom. The boom can be quickly and easily raised or lowered without manual adjustments or affecting the crowding effort. The chain tension is automatically maintained regardless of boom movement.

KOEHRING COMPANY

Pavers · Mixers · Shovels · Cranes · Draglines · Dumptors · Mud-Jacks

3026 WEST CONCORDIA AVENUE, MILWAUKEE, WISCONSIN

The Primary Arcs are so located that many surveys can be directly tied to these primary controls without extending the surveys, and as these surveys are carried across the areas between the arcs the control may be extended to other surveys of all kinds. The relative locations of the primary arcs and the State Highway System are shown on the map of the State. The Texas Section, A. S. C. E., in October, 1933, requested the United States Coast and Geodetic Survey to compute the tables for use in converting from spherical to plane coordinates. This work was promptly initiated and completed by the survey and the tables are now available for the use of all engineers. With the recent issuance of Special Publication No. 189, "First Order Triangulation in Texas" the application of Geodetic control to all surveys becomes relatively simple and easy.

Texas State Highway Department Trial Project.—The Texas State Highway Department, Under the direction of Gibb Gilchrist, State Highway engineer, and Mr. Thomas Kelley, Engineer of Design, is now developing a trial project with the expectation of formulating a procedure to be used in future survey work in the State. This project is located in Kenedy County on State Highway No. 96, extending entirely across the county, a distance of 46.6 miles. The proposed construction will lie between Riviera on State Highway No. 16, in Kleberg County and Raymondville, the County seat of Willacy County, and will pass through Sarita, the County seat of Kenedy County. Surveys for this project were made by Mr. Mason Johnson, Ass'n Member, A. S. C. E., Assistant Engineer, State Highway Department, under the direction of Captain T. W. Bailey, Member A. S. C. E., Division Engineer, State Highway Department, at Corpus Christi. This project lends itself admirably to the use of Geodetic Control, as it is located within the area covered by the Primary Triangulation along the Ninety-eighth Meridian Arc. One of the objects of this study is to obtain cost data on the use of Geodetic Control as compared to the cost of ordinary surveys. It may be contended that a project so ideally located is not representative, but this argument does not apply for it is anticipated that all projects in the first selection will be relatively close to the Primary Arcs and that after the method is well established, survey parties will become more proficient in its application and can extend the process to surveys more remote from the main network. Selection of a project requiring considerable survey work to reach the Primary Arc would have complicated the computations and rendered it difficult to make a satisfactory check on the work, and probably would have discouraged further study of the method.

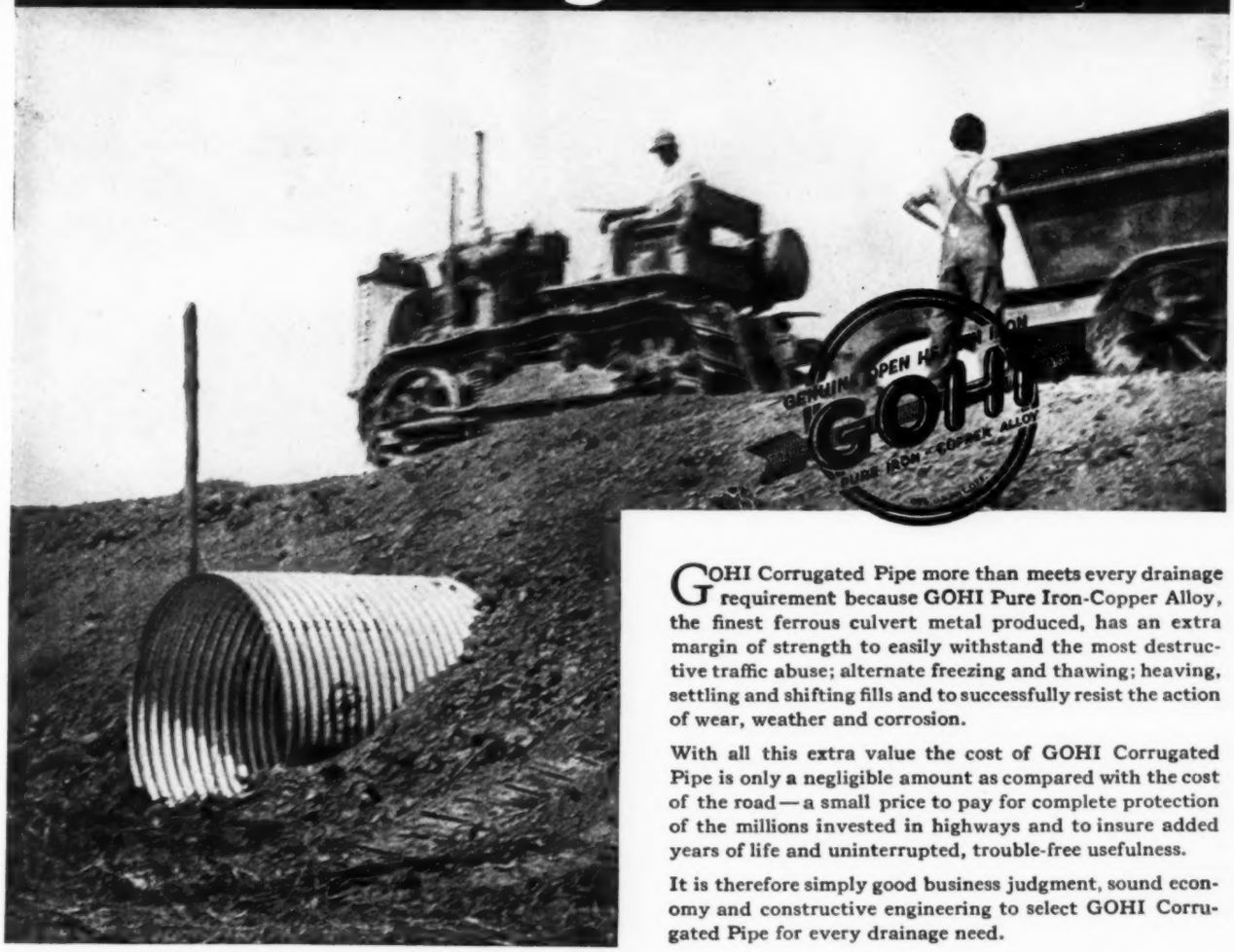
On the Kenedy County Project there are fourteen primary stations adjacent to the project and ten supplemenary points, such as, Riviera Schoolhouse Cupola, Sarita Water Tank, Airways Beacon Site No. 9, and Norias Windmill. These ten points are all within sight of the survey and can be tied in by triangulation of direct measurement. Some of the primary stations are close enough to the line to allow observations and check measurements to be made. The project is located between the 26 deg. and 20 min. and 27 deg. and 30 min. parallels of latitude and is in the "South" belt of the Plane Coordinates as laid out by the Coast and Geodetic Survey. The Plane Coordinates of all primary stations, all supplementary points and all angle points in the survey will be computed and the azimuth, distance between points and various other data will be obtained. All this information will be collected, summarized and recorded for the purpose of establishing a procedure to be followed in working out other problems of this nature. On this first project it was necessary to make a careful study of the publications of the U. S. Coast and Geodetic Survey touching on the subject of Plane Coordinate computation. The publications used are: Special Publication No. 193, "Manual of Plane Coordinate Computation," Special Publication No. 93, "General Theory of the Lambert Conformal Conic Projection," Special Publication No. 57, "General Theory of Polyconic Projections," Special Publication No. 8, "Formulas and Tables for the Computation of Geodetic Positions," Special Publication No. 194, "Manual of Traverse Computation on the Lambert Grid." All these publications may be obtained through the Superintendent of Documents at very small cost. After the work on this first project is completed it will not be necessary to utilize these texts on other surveys, for it is anticipated that sufficiently complete directions can be outlined to allow a locating engineer to make the necessary computations and to tabulate his results on forms prepared for the purpose. Eight place logarithmic tables are required for the computations. The ordinary Engineer's Handbook does not contain these tables and special tables must be obtained.

Advantages of Geodetic Control of Highway Surveys.—The use of Geodetic Control for Highway Surveys offers the following advantages: 1. The establishment of accurate locations for all angle points on the survey with the result that the points may be re-established in their original position at any time and that there will be on file in the central office of the Department absolutely accurate data from which projections of future work may be made. 2. The establishment of a coordinated method of location which may be used to determine with unquestioned accuracy the relative location of all points on the whole system and thus provide a stable and permanent foundation for all future planning and estimates. 3. The stimulation of a desire for accuracy in all surveys which will be reflected in all work based on the original survey. 4. The extension of the control to outlying communities where it may be used as a basis for all surveys and by setting an example for accurate work, the quality of all dependent surveys will be improved. 5. The establishment of a framework for the control of mapping data in the State and consequently the simplification of the task of standardizing the coordination of all mapping data.

It is entirely within the realm of possibility to provide for a reasonably accurate topographic survey covering a belt extending for a mile or more on each side of the important highways. With the center line accurately located the value of such information would be greatly enhanced. This data would be extremely valuable in planning all future developments, studying stream flow, soil erosion, estimating maintenance requirements and for many other purposes.

Use of Geodetic Control for Land Boundary Surveys.—There is a good prospect of the development of the use of Geodetic Control for all land boundary surveys. Massachusetts, Hawaii and New Jersey have given legal recognition of this method and other states are seriously considering its adoption. The Texas Highway Short Course on April 13, 1935, adopted a resolution as follows: "It is recommended that all highway surveys be tied in to the network of the U. S. Coast and Geodetic Survey and that a minimum standard equivalent to second order traverse and levelling be adopted for all surveys. It is also recommended that the plane coordinates computed by the U. S. Coast and Geodetic Survey be utilized in establishing the location of all angle points and that these co-

The FINAL Answer to Drainage Problems



GOHI Corrugated Pipe more than meets every drainage requirement because GOHI Pure Iron-Copper Alloy, the finest ferrous culvert metal produced, has an extra margin of strength to easily withstand the most destructive traffic abuse; alternate freezing and thawing; heaving, settling and shifting fills and to successfully resist the action of wear, weather and corrosion.

With all this extra value the cost of GOHI Corrugated Pipe is only a negligible amount as compared with the cost of the road—a small price to pay for complete protection of the millions invested in highways and to insure added years of life and uninterrupted, trouble-free usefulness.

It is therefore simply good business judgment, sound economy and constructive engineering to select GOHI Corrugated Pipe for every drainage need.

Meets copper-bearing pure iron requirements in all accepted specifications for corrugated metal culverts.

The Newport Culvert Co.	Newport, Ky.
New England Bolt Co.	Everett, Mass.
Central Culvert Co.	Ottumwa, Iowa
Capital City Culvert Co.	Madison, Wis.
F. Yeager Bridge & Culvert Works	Port Huron, Mich.
Bancroft & Martin Rolling Mills Co.	S. Portland, Maine
Denver Steel & Iron Works Co.	Denver, Colo.
The Lane Pipe Corporation	Bath, N. Y.
Dixie Culvert Mfg. Co.	Little Rock, Ark.
St. Paul Corrugating Co.	St. Paul, Minn.

(58)

GOHI

PRONOUNCED "GO-HIGH" CORRUGATED PIPE

GOHI CULVERT MANUFACTURERS, INC., . . . NEWPORT, KY.

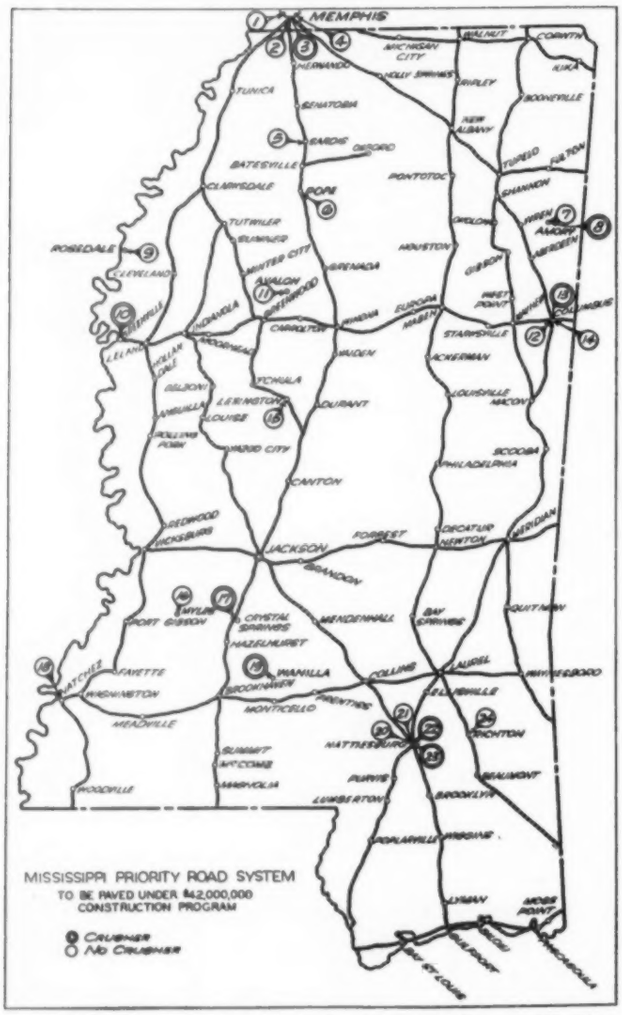
ordinates be indicated on the plans for highway projects. It is recommended that permanent monuments be established at points on the right-of-way where they will not be disturbed; that these monuments be located at the high points of the topography and where they may be easily occupied for instrumental observation; and that they be intervisible, these monuments to be marked with a standard metal disc with proper identification stencilled thereon. The reference monuments and intermediate points will also be used as Bench Marks and the elevations should be adjusted to the U. S. Coast and Geodetic Survey network and plainly marked on the identification discs." The extension of Geodetic Control over all of the State Highway System will hasten the adoption of the use of this method of boundary survey control for adjacent lands, and this one feature will make the use of Geodetic Control for Highway Surveys of extreme value to the public.

The value of sea-level datum for levels based on the bench-marks established by the U. S. Coast and Geodetic Survey is generaly recognized and engineers instinctively use these bench marks whenever they are readily available.

The foregoing is a paper presented before the Surveying and Mapping Section of the American Society of Civil Engineers and printed in abstract form, Civil Engineering.

▼

Location and Owners of Commercial Gravel Plants in Mississippi



(1) *Memphis Stone & Gravel Co., Memphis, Tenn.;* (2) *Missouri Portland Cement Co., Memphis, Tenn.;* (3) *Central Sand & Gravel Co., Memphis, Tenn.;* (4) *Wolf River Sand & Gravel Co., Memphis, Tenn.;* (5) *Memphis Stone & Gravel Co., Sardis, Miss.;* (6) *Memphis Stone & Gravel Co., Pope, Miss.;* (7) *Amory Concrete Gravel Co., Amory, Miss.;* (8) *Amory Sand & Gravel Co., Amory, Miss.;* (9) *Mississippi River Gravel Co., Rosedale, Miss.;* (10) *Greenville Sand & Gravel Co., Greenville, Miss.;* (11) *Lynn Gravel Co., Avalon, Miss.;* (12) *Columbus Gravel Co., Columbus, Miss.;* (13) *Waters & McCrary Gravel Co., Columbus, Miss.;* (14) *Southern Sand & Gravel Co., Columbus, Miss.;* (15) *Green Bros. Gravel Co., Lexington, Miss.;* (16) *Myles Gravel Co., Myles, Miss.;* (17) *Central Mississippi Gravel Co., Crystal Springs, Miss.;* (18) *St. Catherine Sand & Gravel Co., Natchez, Miss.;* (19) *Fair River Sand & Gravel Co.; Wanilla, Miss.;* (20) *Concrete Gravel Co., Hattiesburg, Miss.;* (21) *Hattiesburg Gravel & Supply Co., Hattiesburg, Miss.;* (22) *American Sand & Gravel Co., Hattiesburg, Miss.;* (23) *Forrest County Gravel Co., Hattiesburg, Miss.;* (24) *Richton Investment Co., Richton, Miss.*

▼

Welding Operations on 30-Year Old Viaduct

The Intercity viaduct, connecting Kansas City, Kan., and Kansas City, Mo., has been a traffic bottleneck for years. This structure, 1⅞ miles long, built in 1905-1906, was only 36 feet wide, entirely inadequate for present day traffic. But things are going to be different this fall. The bridge (See Fig. 1), is being widened to 46 ft. The project is being carried out jointly by the state highway departments of Kansas and Missouri.

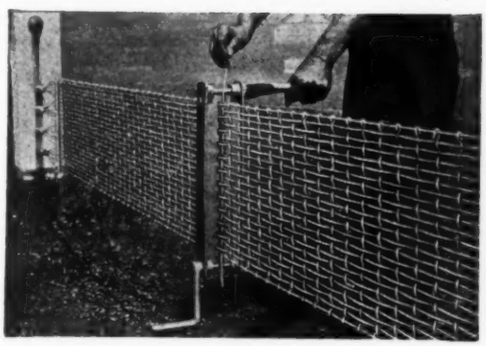
Considerable reinforcing is being done to the bridge to enable it to carry the increased load. Stiffeners—540 of them—are being welded to the main load-carrying members. (See Figs. 2 and 3.) To further strengthen the structure, the heavy floor beams, which were found to be severely weakened by corrosion, are being reinforced by welding steel plate to them. (See Fig 4.) Support for the 4-ft. sidewalks on the north side of the bridge is being provided by a 12-in. stringer (See Fig. 5), arc welded to clips attached to the beams. This construction is shown in Fig. 6.

Approximately 16,000 ft. of guard rail is being added to the bridge. This rail, requiring approximately 350 tons of steel, is being entirely shop fabricated by arc welding by the Builders Steel Co., North Kansas City, Mo., who is also supplying a large part of the steel on the project. The rail is built up in sections, averaging 15 ft. 3 in. in length. The fabrication of a section by arc welding is shown in Fig. 7.

As shown in Fig. 7, a special jig is used to hold the channels and bars securely in place for welding. This method eliminates the need of tack welding. By using this jig, two arc welding operators and one helper who fits the parts together, complete 20 sections of rail a day. According to The Lincoln Electric Co., Cleveland, O., who furnished Fleetweld electrode and numerous Shield Arc welders, the job is proceeding in a very satisfactory way.

The welding on the Intercity viaduct is required to meet specifications of the Kansas and Missouri state highway departments which are the same as those of the American Welding Society. Arc welding operators were qualified according to Welding Society rules.

Contract for remodeling the bridge was awarded to M. E. Gillioz, Monet, Mo., who sublet the erection of the steel to Stroebel Construction Co., Chicago, Ill. The Stroebel Construction Co. is doing the welding.



Pittsburgh Safety Highway Guard is seldom injured by collision beyond the slight displacement of transverse wires. Repairs are quickly made on the spot by unskilled labor, at negligible cost.

Pittsburgh Safety Highway Guard is a strong, slightly resilient, 14-inch band woven with continuous longitudinal semi-spring steel wires having tensile strength exceeding 190,000 pounds per square inch. The shock of any impact is distributed throughout the entire length of the guard, thus saving both vehicle and guard from serious damage. The guard's ultimate breaking strength of 45 tons is ample to stop the heaviest vehicle. A survey of Pittsburgh Safety Highway Guard under actual service conditions has been made by Pittsburgh Testing Laboratory. A summary of their report is available on request.

Pittsburgh Safety HIGHWAY GUARD

PITTSBURGH STEEL COMPANY

742 UNION TRUST BUILDING, PITTSBURGH, PENNSYLVANIA

New York Chicago Detroit Memphis Houston St. Louis
Syracuse Philadelphia San Francisco Los Angeles

Pittsburgh Steel Co., 742 Union Trust Bldg., Pittsburgh, Pa.
Gentlemen:
Please send me, free, a summary of Pittsburgh Testing Laboratory's report on Pittsburgh Safety Highway Guard.

Name ..... Title .....

Address .....

WELDING OPERATIONS ON INTERCITY VIADUCT, CONNECTING KANSAS CITY, KAN., AND KANSAS CITY, MO.

Fig. 1—Intercity Viaduct Between Kansas City, Kans., and Kansas City, Mo., Being Widened and Reinforced by Shielded Arc Welding.

Fig. 2—Reinforcing the Floor Beams of Intercity Viaduct by Arc Welding Stiffeners to the Beams.

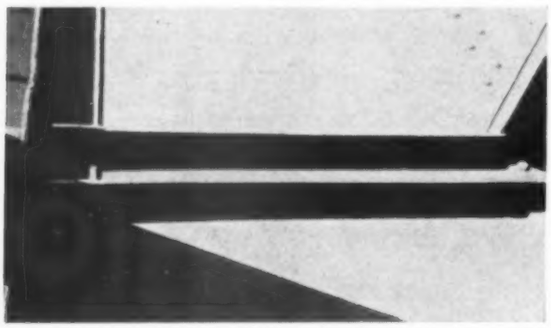


Fig. 3—Close Up of Stiffeners Arc Welded to Beams of Intercity Viaduct.

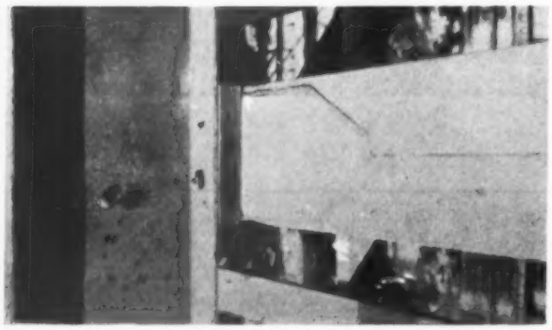


Fig. 4—Steel Plate Fused by Electric Arc Welding to Floor Beams for Reinforcement.

Fig. 5—Twelve Inch Channel (Right) Installed for Sidewalk Stringer on Intercity Viaduct.

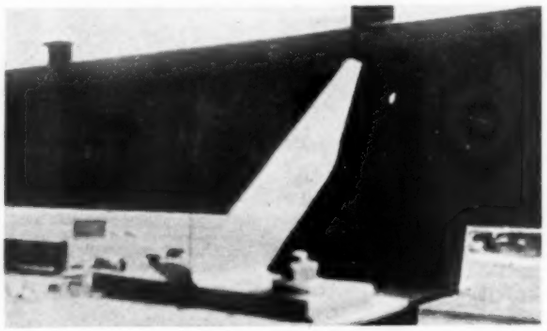


Fig. 6—Brace for Sidewalk Stringer on Intercity Viaduct, Welded to Clip Attached to Beam and Stringer.

Fig. 7—Fabricating a 15 Ft. 3 In. Section of Guard Rail. This Jig and Arc Welding Enable Two Welders and One Helper to Fabricate 20 Such Sections Per Day.

Fig. 8—Arc Welding Machine Used in Widening and Strengthening Intercity Viaduct.

2 HIGH SPOTS IN WIRE ROPE MANUFACTURE

• Purple Strand—in itself—is an unusual rope where extreme strength is required

and

• Where *Pre*formed suits your requirements better, "Form-Set" Purple Strand—Williamsport's method of *pre*forming — will give you remarkable service.

Let us send you our new Catalog and manual just off the press. Tell us what your requirements are and the service you require, our engineers will gladly aid you.

You'll be pleased with our way of doing business.

Purple Strand

Form-Set

Williamsport

WIRE ROPE COMPANY

WILLIAMSPORT, PA. 122 So. Michigan Ave., CHICAGO, ILLINOIS

Other Offices in All Principal Cities

Observations by the Way

By A. PUDDLE JUMPER

¶ This picture shows a curve within 25 miles of Ames, Iowa, where a highway safety conference was in progress at the time this was written. The third post in the guard fence stands as mute evidence of the

lack of safety built into this main road, the Lincoln Highway, U. S. 30, east of Ames. The curve jumps out of the dark at the motorist traveling 60 miles an hour and is too sharp to be negotiated well at 40 miles an hour. Highway safety needs to be built into this road. Only a modernization project can do it.

• •

¶ Indiana has provided drive-off areas made of crushed rock at frequent intervals along both sides of U. S. 41, south of Hammond. This is a good idea for this heavily travelled road and could be advantageously used on other highways in the country over which I have driven. The drive-off area is 10 ft. wide and 50 or 60 ft. long.

• •

¶ The contractor who built U. S. 10 east from a point about five-miles east of Appleton, Wis., deserves a note of commendation on the skill and artisanship employed as demonstrated by the smooth driving surface. The road had excellent engineering also as was evidenced by the super-elevation of curves, curb and drainage on inside of curves and lack of cracks. This concrete road I estimate is about two years old.

• •

¶ New London, Wis., looks old. The cause of this is that old high truss narrow bridge right in the center of the town. It should be removed and a new wide, trussless type constructed.

• •

¶ Detroit and Wayne County, Michigan, are to be complimented on the foresight used in handling their traffic. Speedy entrance and exits to and from the heart of the city leaves the business traveler satisfied with his schedule.

• •

¶ Those are certainly smooth, well-maintained gravel roads on the county and township systems around Madison, Wis.

• •

¶ One maintenance job commonly overlooked in the many states I have traveled is the removal of gravel surfacing that is brushed on the hard surfaced roads at intersections where gravel surfaced roads meet hard surfaced roads. It is not uncommon to see a mass of loose gravel extending for the 3 or 4 ft. onto the surface of paved roads at intersections.

• •

¶ That was one big letting they had at Lansing, Mich., on June 30 when the State Highway Department opened bids on $5,750,222 worth of highway and bridge construction projects. The bids were the first taken in Michigan's new $7,600,000 Federal Aid program for the fiscal year beginning July 1. Was the largest single letting in the entire history of the State Highway Department.

• •

¶ Those officers of the state highway patrol of Minnesota are handy men to have around, except of course when you are violating the traffic laws. During the first four months of this year they traveled 1,416,714 miles and in addition to warning 30,785 traffic law violators, handing out 10,858 tags for illegal equipment and arresting 1,304 persons for violations of the traffic code, they made 5,759 minor adjustments and repairs for motorists, pulled 1,472 cars out of ditches, delivered gasoline 477 times to cars out of fuel and called garages 1,015 times for stalled motorists.

• •

¶ Have you noticed the new developments in hot mix asphalt plants? The city of Detroit, Mich., has one of the latest and what is said to be one of the best installations in the country.

• •

¶ Where is the governor of Georgia getting the money to run the state if not by diversion of gas taxes and motor vehicle license fees? The last legislature, I am told, did not pass an appropriation bill.

• •

¶ Of all power shovels working in the highway industry about one in forty is steam. Manufacture of new steam shovels and cranes is practically zero.

• •

¶ Fred Streich, manufacturer of wagons, is working with a four-wheel steer and drive truck manufacturer on a unit to haul 12 yards of earth from the digging unit to the dump at 40 miles an hour. Speed is even entering into the building of the road.

• •

¶ If you want to get a moving picture of yourself try reckless driving on some of the state highways of Colorado. The state police are now equipped with motion picture cameras and take movies of such drivers.

• •

¶ The street repair foreman at Manitowoc, Wis., Mr. Diskowski, is proud of the city's maintainer. He was scarifying the street subgrade with it preparatory to smoothing to get ready for the city's centen-

Manitowoc's Maintainer Scarifying Subgrade. Mr. Diskowski says he could use another machine like this one if the council could be persuaded to buy it.

nial celebration. The street, unfortunately for the celebration, is torn up preparatory to paving. Calcium chloride is going to be spread to settle the dust during the festival.

EVERY NIGHT MILLIONS OF MOTORISTS NEED THE SAFETY OF

CONCRETE

VARIOUS authorities agree that the death rate per automobile accident is much greater after dark than during daylight hours.

At the recent meeting of the American Association of State Highway Officials, an authoritative speaker pointed out this fundamental fact: *A light-colored matte surfaced pavement offers best visibility and therefore greatest safety by night.*

Concrete meets that requirement perfectly. Its light gray matte surface reflects more light; brings obstacles and pedestrians into relief; makes passing safer. Its sharply defined edge helps motorists stay on the road.

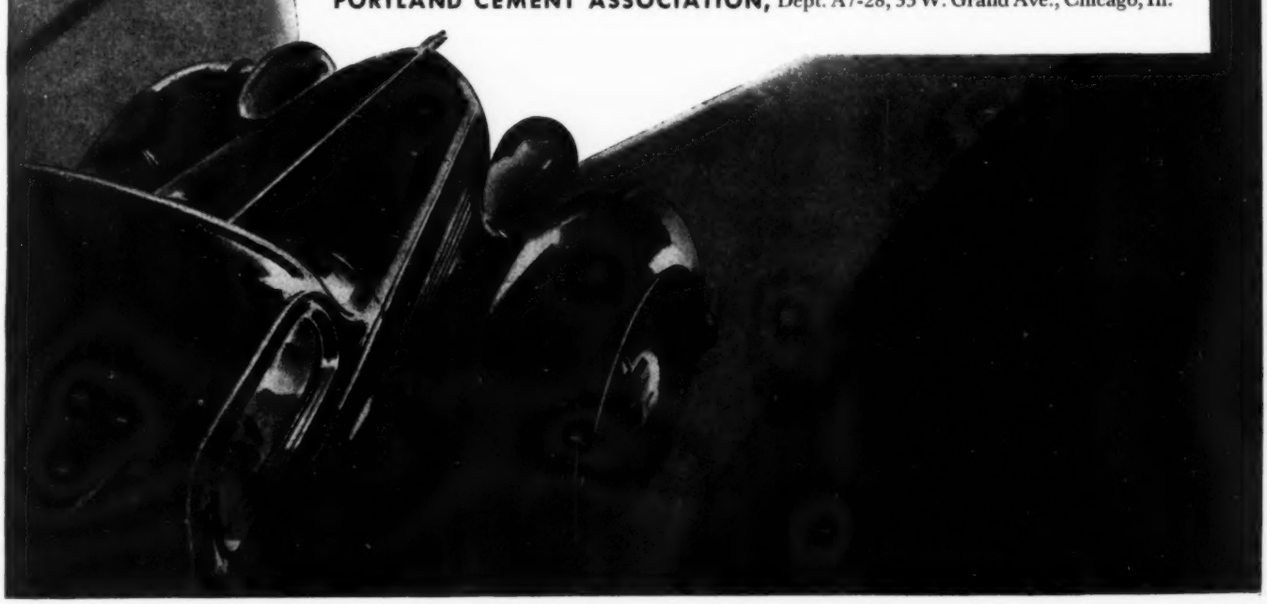
Concrete conforms to the standards for safe pavements set up by the Illuminating Engineering Society in 1934. In the proceedings of the 13th annual meeting of the Highway Research Board it is stated that the reflection factor for portland cement concrete is many times higher than that of dark colored pavements.

That's only a part of concrete's story. In addition, it is skid-resistant, wet or dry . . . it saves motorists money by reducing gas, tire and repair bills . . . it costs less than other pavements of equal load-bearing capacity . . . and no other pavement even approaches its economy of surface maintenance.

Economics, design and construction of concrete pavements are summarized in our Concrete Pavement Library. Let us send you any or all of the booklets—

(1) "*Rational Planning of a Public Highway Program*"; (2) "*Concrete Road Design Simplified and Correlated with Traffic*"; (3) "*Short Count Traffic Surveys*"; (4) "*What Old Concrete Roads Tell Us*"; (5) "*Concrete Pavement Manual.*"

PORTLAND CEMENT ASSOCIATION, Dept. A7-28, 33 W. Grand Ave., Chicago, Ill.



Yes—We would like you to mention ROADS AND STREETS

¶ A man up in Madison, Wis., has invented and is testing out a railroad grade crossing protective device that holds a vehicle from reaching the tracks. It is stretched across the road like a barrier and when the vehicle strikes it, the cables compress springs and it stretches for forty feet or so, but holds the vehicle.

• •

¶ Another inventor devised a barrier type of grade crossing protection that raises up out of the roadway and is designed to damage the steering mechanism of a speeding car that fails to stop at a grade crossing when a train is approaching. The car is actually stopped or deflected off the roadway before reaching the tracks.

• •

¶ Some way should be devised of widening some of the narrow bridges on our main roads. A bridge should be at least four feet wider than the highway to overcome the mental hazard set up in a driver's mind.

• •

¶ On quite a few Iowa roads the shoulder is too narrow. It should be wide enough for a car to get clear off of the hard surface. When I got a flat tire (from nails picked up on the gravel stretches near Sac City) I could not get off the concrete entirely to fix it. I was a traffic hazard and could not help it.

• •

¶ Those stretches of formerly rough concrete resurfaced with brick around Sterling, Ill., certainly are good surfaces. The strip of white concrete on the edge forms a mental guide leaving a satisfied feeling of safety. Let's have more of that.

• •

¶ If I had my way, I'd separate traffic lanes of opposite direction with a strip of parkway or even bituminized gravel.

• •

¶ I am told that in a recent deal a manufacturer of a large piece of construction equipment cut prices to make the sale when competing with another make. This is the second price-cutting story on construction equipment about which I have been told. We hope this dangerous practice will not continue because if it does, we'll be back in another depression where we were in 1932 and 1933.

• •

¶ I understand that Mississippi has adopted the policy of not letting over a million dollars worth of work to one contractor.

¶ Cunning little warning for speeders is being used at Maryville, Calif., on a dangerous curve. It sure makes a hit with the lady drivers. The warning consists of a skeleton, with a cigar in its jaws and a whisky bottle at its side, seated in a demolished automobile.

• •

¶ Wisconsin has a serviceable road signing method that it would be well for Iowa and Illinois to consider. The night driver, hitting it up at 50 miles an hour, can easily follow the route he selects and know when to slow down to turn off onto the next route. Those signs in Wisconsin advise, far enough ahead of an intersection, what towns are which way and how far.

• •

¶ I noticed a novel stump pulling hook with cable arrangement over in Mills County, Iowa; a clearing idea on a country road. The picture here-

Patterson Choker Hook in Stump Pulling

with shows the idea and how it works. The hook gives a twisting leverage on the pull.

• •

¶ Isn't it too bad that Iowa designed the curves on her state system hard surfaced roads so sharp. They are 40-mile an hour curves. The long straight stretches of road invite 55 and 60 miles an hour speed but when a curve looms ahead the speed must be cut to 40 miles an hour in the best weather. They should be negotiated at the same speed. With 90-mile-an-hour automobiles on the highways, it is provoking to the driver to have to slow down to 35 and 40 miles an hour on a clear curve.

• •

¶ It is claimed that Western contractors, west of Rocky Mountains, never think of putting their machinery on a job without including a welding outfit as part of the first shipment. They claim that these units pay for themselves in a very short time. This sounds reasonable considering the great amount of welded equipment made today. Have you bought your unit yet?

• •

¶ I rode in a test car of the Goodyear Rubber Co., at the Highway Safety Conference at Ames two weeks ago when the driver dynamited a left rear tire. The car was going 70 miles an hour and after the tire was blown out it never swerved a mite from the straight line it was traveling. The tire was equipped with a new type of double tube that prevents the casing from going clear flat in case of a blow out. Later on the driver struck a group of inverted sharpened railroad spikes and blew out casings on both left side wheels. The car never swerved in this case either, though both tires on the left side were blown out.

• •

¶ Why did Iowa's big highway program fall down this year? Can it be that lack of field surveys because of late snows is a plausible excuse?

• •

¶ Is Chicago ever going to get a fast motor route west out of the loop? Not enough effort has been expended to obtain Federal funds for a fast, through street west from the loop.

• •

¶ Saw a horse and buggy near Peoria, Ill., and the horse wasn't scared at all when we passed him. Seems like there must be quite a few automobiles in these parts now.

• •

¶ Have you noticed the new "pull out" parking places the Michigan State Highway Department is constructing at frequent intervals along the main highways? These parking places provide plenty of room so that anto-trailer or trailer-coach outfits, now so numerous, can tarry by the wayside without endangering through traffic.

• •

¶ Vermont may be the 45th state in population and also 45th in number of vehicles registered, but it is first in one respect. It has the highest motor vehicle fees of any state. The average charge in 1935 was $28.22.

• •

¶ "The price that we are paying for speed and convenience in motor travel so far is too high."—John W. Wheeler, Commissioner, Indiana Highway Commission.

• •

¶ When will Kentucky start paying estimates?

BUILT FOR DAY AFTER DAY PERFORMANCE

Strength—the ability to take the battering shocks and strains of heavy construction work—is an outstanding characteristic of all Le Tourneau equipment. This strength is achieved by the use of special high-tensile, alloy steels—made to exacting Le Tourneau specifications—and electric arc welding—there are no castings, no rivets to work loose or shear off. As a result, Le Tourneau construction is stout and rigid, stands up, repairs are few and easily made, equipment life is prolonged, maintenance costs are extremely low, and big, hourly yardages are delivered steadily day after day.

Ask your "Caterpillar" tractor dealer what this ruggedly-built, job-proved equipment is doing for owners the country over. Buy proved equipment—Le Tourneau equipment.

R. G. LE TOURNEAU, INC.

Peoria, Illinois — Stockton, California

Cable Address: "Bobletorno"

MANUFACTURERS OF: ANGLEDOZERS, BUGGIES, BULLDOZERS, CARRYALL SCRAPERS, CRANES, DRAG SCRAPERS, POWER CONTROL UNITS, ROOTERS, SEMI-TRAILERS.

LE TOURNEAU

In the Blue Ridge Mountains—It takes stout equipment to consistently handle loads like this one on a road job in the mountains of North Carolina.

Job Handyman

Le Tourneau Cranes will cheaply and quickly handle a multitude of tasks from loading and unloading equipment to the placement of heavy timbers and culverts. They are made in three boom lengths, 20, 30 and 40-foot—for all size tractors and are operated by means of Le Tourneau Power Control Units.

Sure It's Easy—The Le Tourneau Crane picks up an 8-Yard Carryall, weighing 11,500 pounds, and puts it on a flat car.

EDITORIALS

Planning Future Highways

SINCE the passage of the Federal Highway Act in 1921, the State and the Federal government have concentrated efforts to complete a limited system of interstate and intercounty highways amounting to about 7 per cent of the total highway mileage in the nation. They have stuck to this job so faithfully that is now possible to travel on good roads from one part of the country to another. The continuous improvement of this 7 per cent system was the direct result of advanced planning well-done.

State highway officials and the Federal government can no longer confine their joint efforts to the planning and construction of a national highway system without giving due consideration to some 2,600,000 miles of secondary roads representing more than 90 per cent of the total road mileage. The time has arrived when Federal-aid highway funds should be apportioned on a broader basis than in the past and proper attention should be given to planning the improvement of those secondary roads which actually are now or are to become feeder roads to the trunk line highways. Under the Emergency Legislation of the past few years, Federal funds have been paid for desirable improvements on secondary roads thus providing employment in areas where relatively large unemployment existed, but no coordinated effort had been exerted to make these and other secondary roads a component part of a national highway system.

As stated briefly in a recent issue of this publication, the Hayden-Cartwright Act of 1934 authorized the expenditure of Federal highway funds to pay for surveys, plans and engineering investigations for future construction either on the Federal-aid highway system and its extensions or on secondary or feeder roads. These investigations are being conducted by the State highway departments under the advice and direction of the Bureau of Public Roads and the results will be published upon approval by the agency. Within the past two years about $16,000,000 of Federal highway funds apportioned to the States have become available for this work. It is, of course, too early to predict the results of these investigations and their applications, but it is not too early to see the need for them. When the work is completed we shall expect to know what additional roads are to be improved and what roads should be omitted from a national and local program of improvement, how many miles are to serve truck traffic and how many are to serve lighter weight vehicles, what roads will serve city property and what will serve agricultural areas, what cities are to be by-passed and what bottlenecks can be eliminated. These and other facts when established will provide a sound basis for future highway development and equitable taxation with which to pay for it.

In addition the data will definitely show the benefits of road service to rural residents and urban residents and how much each should contribute. We shall more accurately know the value of the so-called intangible benefits of roads about which we have talked in general terms, what it is worth to go to church, if you will, to have a doctor, if you must, to go to school and return back home. Roads are here to stay and we need to know, in fact we must know, what it costs to own and operate them, where they should be built, who shall pay for them and what is fair tax on those who pay. We now have the time, money, personnel and leadership to carry this undertaking to a useful conclusion and no other undertaking with Federal highway funds is likely to return a greater value per dollar invested than this much needed survey.

Highway Safety

THREE factors in highway safety are:

1. The road.
2. The car.
3. The driver.

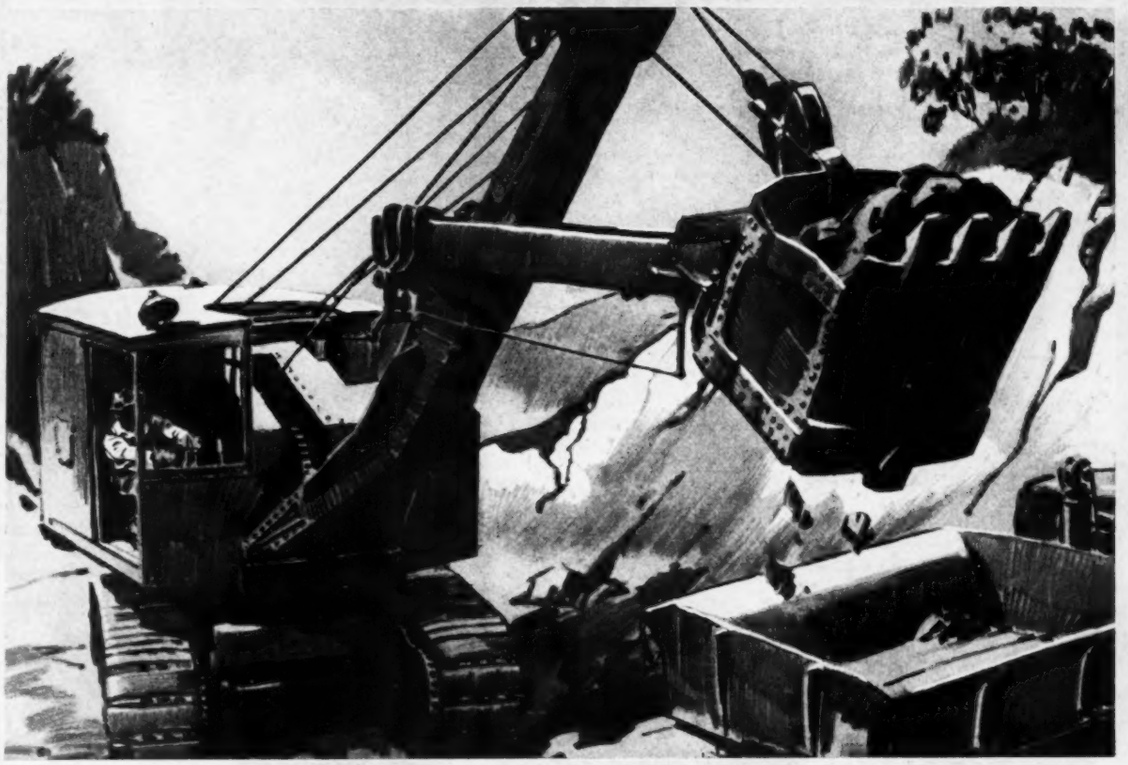
It is conceded that, in a general way, the highways are constructed for safe travel. Of course there are many places that are sorely in need of modernization—the 40-mile and hour curves in Iowa, for instance. But, in general, safety has been built into our highways. Four lane roads are needed in many places and many states are studying their problems through the means of the highway planning surveys.

In Indiana, for an example, there is a committee of thirteen appointed to study the highway program for the state for the future. They are to make recommendations to the legislature. It is expected that the highway planning survey now in progress in cooperation with U. S. Bureau of Public Roads will be used as a basis for their recommendations. No doubt highway safety will be given considerable attention in this study.

So far as the motor car is concerned it may be admitted that manufacturers are designing safety into them. All-steel bodies, life protection tubes in case of blowouts, oversize brakes, and safety glass are a few examples. The designer, however, also designed 90-mile an hour speed. Now the silly part of this transportation scheme of design is that the highway designer and the motor vehicle designer never get together to coordinate their designs with transportation as the key to the problem.

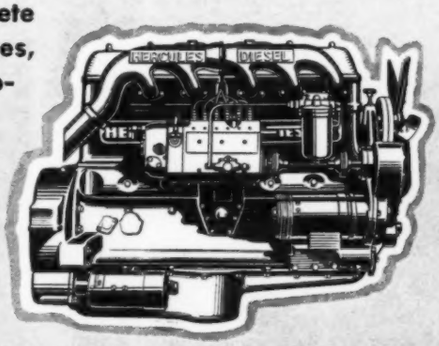
We now consider the third and most vital factor—the driver. In other words, the steering wheel and pedals are the point now requiring most attention. In Iowa, and we presume in some other states, there is organized an Iowa Safety Council whose function is that of promoting courtesy or sportsmanship on the highway. They have made arrangements with law enforcing agencies for the receipt of reports of traffic violations in cases where safety is at stake. Each member is equipped with a shield for the back of his car and a sticker for the windshield. The violations reported will receive consideration the same as though reported by a traffic officer. The organization also carries its safety story in visual form and print to schools and civic meetings.

It is believed that this is an excellent way to educate the public in street and highway safety. In the matter of courtesy on the highway nothing brings this point out clearer than the old slogan that appeared in many places a few years ago—"If you spit on the floor at home, spit on the floor here." In other words be as courteous on the highway toward others as you would be toward them in your home. Courtesy and sportsmanship in driving will solve a considerable part of accidents, injuries and deaths on the highways.



HERCULES ENGINES

GOVERNMENT SERVICE—Hundreds of Hercules Engines, gasoline and Diesel, are in Government service, both state and federal. They provide dependable power for shovels, tractors, concrete mixers, ditchers, dredges, pumps and industrial locomotives, road scrapers and scarifiers and heavy-duty trucks—all used on state and federal projects from Maine to California. Hercules Engines have long been used in every type of modern heavy-duty machinery. The United States Government, in selecting Hercules-powered equipment, has the assurance of over twenty years of experience—devoted solely to building heavy-duty power plants. The long experience of the Hercules organization in designing and producing heavy-duty engines is available to all manufacturers in planning any type of application.



HERCULES MOTORS CORPORATION, Canton, Ohio

America's Foremost Engine Manufacturer • Power Plants from 4 to 200 H. P.

NEW EQUIPMENT AND MATERIALS

New Type Air Hose Features Combination Construction

Hipress air hose, a new product designed for all types of air tool applications, has been announced by The B. F. Goodrich Co., Akron, O.

This hose is unique in that it is a combination construction made in long lengths. The inner carcass consists of four plies of specially woven duck. The outer carcass is a tight braid of high tensile cords which are applied with a tension ten times that normally used on longth length braided hose. Between the inner and outer carcass is a substantial insulation which serves as a secondary tube to seal off penetration of air through the walls of the hose and to cushion blows from the outside.

The wrapped construction of the inner carcass provides an ideal backing for the tube due to the fine weave of the fabric. This is particularly valuable when tube is subjected to softening from internal heat. Due to the bias design of the wrapped fabric, any air or fluid which reaches it travels only a short

New Type Air Hose

distance before reaching terminal point of the yarn, thus preventing penetration throughout entire length of hose. However, the use of an outer braided carcass gives greater flexibility and more secure adhesion of cover than is obtainable with an all-wrapped construction.

The tube is made of a special rubber capable of resisting both oil and heat. Not only is it claimed that this tube will last longer in air hose service where oil is present but that it will not break into loose particles and clog the tools. The rubber cover of hose is compounded to withstand abrasion and abuse.

Hipress air hose is furnished in three sizes, ½-in., ¾-in. and 1-in., and will be made in 500-ft. lengths.

▼

New Streamlined Emulsion Sprayers

A completely new idea has been built into the new 1936 line of emulsion sprayers of the Littleford Bros., 454 E. Pearl St., Cincinnati, O., giving these units, it is claimed, the utmost in safety, operating efficiency and ease of handling.

A channel iron running gear is used on both the No. 93-AM and No. 93-OB. The main supply tanks are made longer, of smaller diameter. This adds to the stream-lined effect of appearance and makes a stronger unit throughout. Pneumatic tired Timken roller bearing wheels are semi-elliptic spring mounted on the chassis.

The pressed steel hood over the air cooled motor and compressor opens up, when unit is being used, to give complete ventilation and free access to all parts. Closed, the hood is securely locked by one latch. Everything is easy to get to.

A new and exclusive safety feature is built into the No. 93-OB unit (which handles cut-back, where heat is required). A simple but quite positive arrangement makes it impossible to operate the oil burner while pressure is being applied to the main tank. By the same device, it is impossible to apply pressure to the tank while the oil burner is burning. The operator has his choice, instantaneously produced, fool-proof and certain.

Both No. 93-OB and No. 93-AM (the unit built to handle

New Emulsion Sprayer

cold materials) fill themselves from the commercial drum. They are made in one and two drum sizes. A strainer in the filling manhole and a siphon pipe draw off prevent clogging of lines. By simply turning on one valve, however, the operator can utilize the pressure in the main tank to blow out lines, spray hose and nozzle. The heat flue in No. 93-OB is located at extreme bottom of supply tank.

All fuel piping is of streamlined copper tubing and fittings. No. 93-AM is exactly the same unit as the No. 93-OB with the exception of burner, heat flue and fuel tank and the necessary valves and piping.

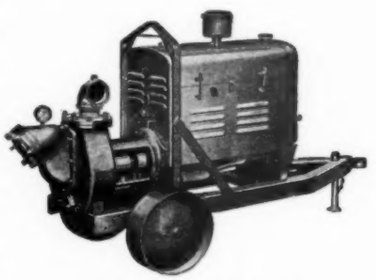
To augment the line, an inexpensive hand pumped type of sprayer is built, the No. 93-AH. This unit uses the commercial drum as the pressure vessel and uses a hand pump. It, too, has been designed to suit the modern mode and is standardly equipped with pneumatic tires.

Full information about these units, as well as the large sprayer unit, the No. 101 Utility Sprayer, can be had by addressing the manufacturer, asking for Bulletin K-5.

▼

New Self-Priming Centrifugal Pump

A new line of highly efficient self-priming centrifugal pumps of the most advanced design ranging in size from 2 in. to 8 in. and having capacities in accordance with the standardized ratings of the Contractors' Pump Manufacturers' Association, has been announced by the Sterling Machinery Corporation, 411 Southwest Blvd., Kansas City, Mo.



New 4 in. 40M Pump

Some of the noteworthy features of this new construction are larger pump cases, quicker priming action, built-in check valves, double grease seal, rugged, sturdy construction and entire absence of gadgets and settling tanks.

A radical departure is made by this company in the construction of their new 4-in. 40M pump (shown in the illustration), 6-in. 75M pump, 6-in. 90M pump and 8-in. 125M pump. All of these have the impellers mounted on a sturdy shaft supported by two heavy duty ball bearings which is driven from the engine by a heavy duty flexible coupling of improved design. The support bracket for the pump is bolted to the engine to assure permanent alignment.

The corporation has found it necessary to double its capacity and the size of the plant. The new plant will be completely equipped with all new machine tools.

BLAW-KNOX *Finish-Spreaders*

KNOW MORE ABOUT THIS SIMPLE, LOW COST ROAD BUILDING UNIT

The Blaw-Know ROAD FINISH-SPREADER will spread and finish stone or gravel; hot or cold asphalt—one to fifteen feet wide—half a road at a time. Will lay varying widths on curves fully or partially banked—*with one machine at a fraction of the usual cost.* (Ask Blaw-Knox to send you Catalog No. 1523—"The Blaw-Knox Road Finish-Spreader."

BLAW-KNOX COMPANY, 2003 FARMERS BANK BLDG., PITTSBURGH, PA.
Offices and Representatives in Principal Cities

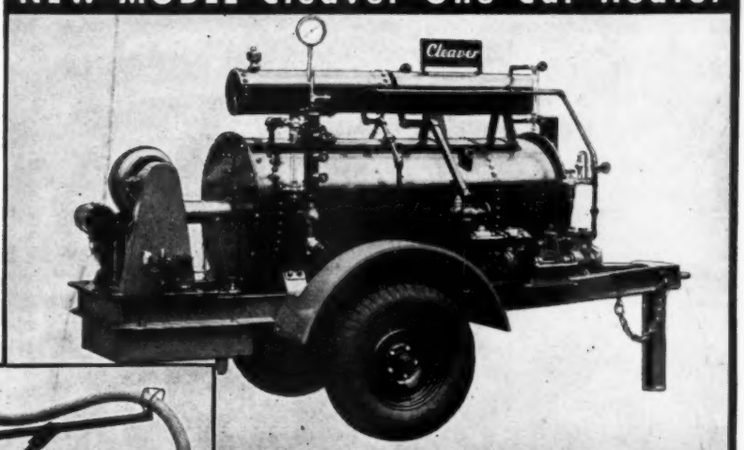
for Economical Bituminous Paving

You start to

SAVE

when you start to **USE...**

NEW MODEL Cleaver One Car Heater



NEW MODEL Cleaver No. 1 Booster

Cleaver

TANK CAR HEATERS AND BOOSTERS

Cleaver tank car heaters and boosters available in sizes and models to fit every requirement.

Write CLEAVER-BROOKS CO.
Dept. L, 129 W. Wells St. Milwaukee, Wis.

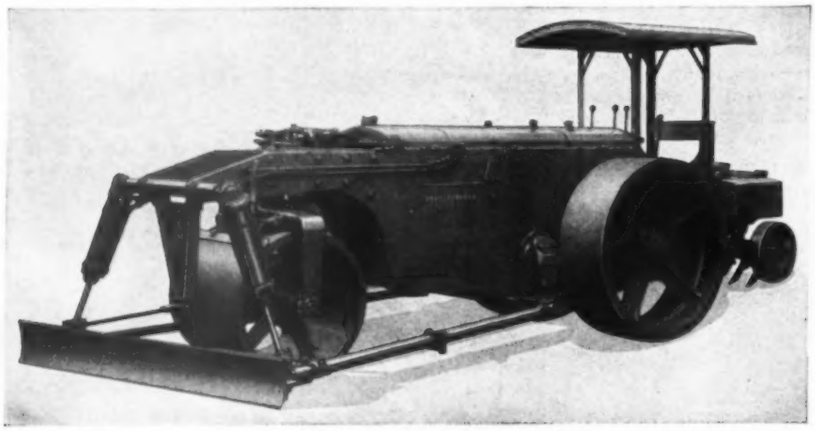
A New Planer Attachment for Rollers

Austin-Western Road Machinery Co. of Aurora, Ill., has recently developed a new hydraulically controlled planer attachment for use with 6, 7 and 8-ton rollers.

The attachment consists of a 7-ft. blade and is designed for use in finishing subgrade and other types of grading where rolling is required. A 2-ft. extension may be added at either end if desired. The blade bit is reversible.

The blade may be set to remove excess of material at any height and may be set straight across the machine or angled to allow material to windrow to the left of the roller.

Rapid vertical adjustment is assured by hydraulic control valve operated from the roller platform, and responding instantly to the touch of the operator.



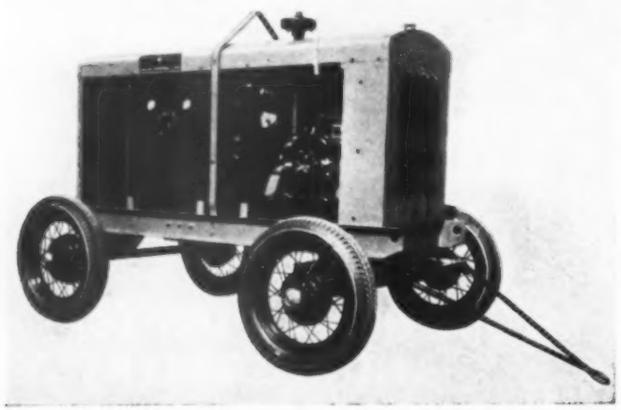
New Planer Attachment for Rollers

The manufacturers claim that the principle of operation is parallel to that of the third axle center roll of their Roll-A-Plane, since by placing the heel of the planer on the same plane as the front and rear roll, three points are established in the same place. As a result the high spots are found and leveled by the action of the planer to create a level surface.

▼

New Welder

A new welder, designed for extreme portability and sturdiness, has just been announced by American Tractor Equipment Co., manufacturers of ATECO earth moving equipment. This new welder is available either with or without a rigidly connected trailer undercarriage, there is a convenient bail attached directly to the main frame so it can be lifted into difficult locations by a crane or loaded and unloaded from a truck



readily, and as a final means of portability, the ends of the main frame members are bored for insertion of bars for hand lifting.

Power is supplied by a four cylinder Ford industrial motor, developing 23 horsepower SAE rating. Radiator electric starter and fan of Ford make are provided. The generator is of Ateco-Roe design and construction, with a capacity of 300 amperes.

On wheels, the welder weighs approximately 2,200 lb.; on skids, 1,850 lb. Wheels are standard automobile type, carrying regular automobile pneumatic tires of 4.75-19 size, readily available everywhere. Axles are heavy steel, made by Ateco and welded rigidly to the welder frame to eliminate sidesway in towing the device.

▼

Street Series Lamp Has Bi-Post Base

Revolutionary changes in the design of its 4,000 lumen, 6.6 ampere, street series lamp, namely, a horizontal filament, a tubular bulb, and a bi-post base, are claimed to promise more accurate control of street and highway lighting so desirable in the trend of greater traffic safety through the medium of higher levels of illumination, according to an announcement by the Westinghouse Lamp Co., Bloomfield, N. J.

An outstanding feature of the new lamp is its filament design. The horizontal filament reduces the vertical height of the light source, making possible improved vertical light control by accessory equipment which in turn permits reduction of glare.

The medium bi-post base incorporates prefocusing characteristics assuring accurate light center length and correct axial alignment and facing of the filament. These features contribute to accurate light control in street lighting fixtures.

Designed in a T-20 clear bulb, the new lamp is for base-up burning only. The pyrex bulb eliminates the need for expensive waterproof fixtures.

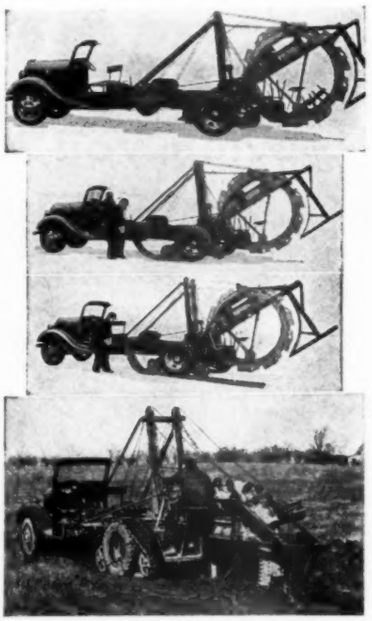
▼

New Small Ditcher

A new ditcher claimed to have a wide range of service in small trench digging has been placed on the market by The Buckeye Traction Ditcher Co., Findlay, O.

Mounted on Ford, Chevrolet, or other standard truck chassis, the ditcher can be moved rapidly from one location to another at regular road speeds. The truck motor furnishes the power for the ditching mechanism through a special transmission. The motor is supplied with an oversize radiator for better cooling facilities.

Buckeye "Alligator" crawlers are supplied direct to the dual rear wheels. Small detachable idler wheels in front and behind the rear wheels increase the crawler area, thereby enabling the ditcher to work on soft ground. These "Alligator" traction wheels may be put on or taken off and conveniently stowed away in approximately 20 minutes.



Buckeye Model 16 Utility Ditcher

The Model 16 Utility Ditcher is built with the same rugged construction and engineering as the large Buckeye pipeline ditchers. It has a maximum cutting depth of 4 ft. 6 in., and cutting

BAKER

BULLDOZERS

OTHER BAKER PRODUCTS

SCRAPERS
ROOTERS
ROAD DISCS
SNOW PLOWS

Do what hundreds of contractors are doing on the big projects. Use the Bulldozer with direct lift. No cranks, gears, springs or levers on lifting mechanism. Instant control plus stamina for tough jobs.

Send for Bulldozer Bulletins.

THE BAKER MANUFACTURING COMPANY
506 Stanford Ave. Springfield, Ill.

"A Mammoth Job"

ALL contractors building the gigantic New York City Triborough Bridge selected FLEX-PLANE FINISHING MACHINES exclusively because of their utility. Solving many unusual problems was made easy. Six FLEX-PLANE FINISHING MACHINES, ranging from 10 to 40 feet wide, are engaged in surfacing the concrete runways.

FLEXIBLE ROAD JOINT MACHINE COMPANY
WARREN, OHIO

An AUTOMATIC owner writes:

*"We have been convinced that the AUTOMATIC bucket has increased our production at least 50%. "The Page bucket will dig in deep holes as long as you keep rope long enough to go deeper. On one of our jobs we had hard pan,— other type buckets slid over the top of this material. The Page AUTOMATIC came through full every drag we made"**

*From a letter in our files.

You also can speed up your dragline work — increase yardage 20% to 50%. Learn all about the digging advantages of the Page AUTOMATIC—ask users—see your equipment dealer—or, write us direct. Address Department "R." Bulletin "THE AUTOMATIC" gladly sent on request.

BUILT IN SIZES 3/8 to 15 CUBIC YARDS

"DIG WITH A PAGE AUTOMATIC"

PAGE ENGINEERING COMPANY
CLEARING POST OFFICE CHICAGO, ILLINOIS

width from 9¼ in. to 16½ in., and digging speeds from 1.45 ft. to 15.85 ft. per minute.

For complete information regarding this ditcher, write to The Buckeye Traction Ditcher Co., Findlay, O., for their latest bulletin on Model 16.

▼

New Wagon Mounting for Rock Drills

A new light-weight wagon mounting for fast and powerful rock drills has been announced by the Ingersoll-Rand Co., 11 Broadway, New York City. It is stated to fill the gap between the large I-R drills and the hand-held Jackhamer. It will handle 20-ft. steels and will accommodate a 6-ft. steel change.

I-R Wagon Mounting

The new unit has great versatility, with a positive feed at any angle. Feed is by air-motor, with an infinite range of feed pressure from 1 to 1,000 lbs. A self-locking worm drive permits feeding the drill up to the rock exactly as with a hand-cranked drill. The new mounting provides an easy and fast method of handling the heavier drills, resulting in increased yardage with less fatigue to the operator. The mounting can be equipped with pneumatic tires, which make it much easier to move or transport. Copies of Bulletin No. 2253 describing this mounting may be obtained from Ingersoll-Rand.

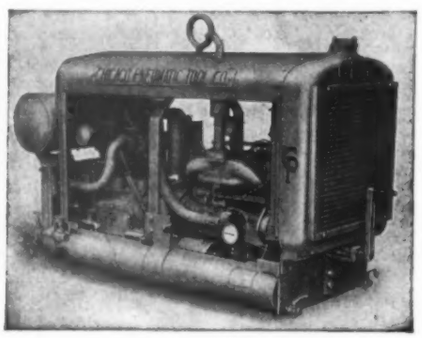
▼

New Portable Air Compressor

A new two-stage, air-cooled gasoline engine driven compressor, particularly designed for use by public utility companies and others who would have use for a small, easily moved compressor of this type, has been placed on the market by the Chicago Pneumatic Tool Co., 6 East 44th St., New York. The compressor can be mounted crosswise on a motor truck, thus leaving more body room for hauling men, equipment and material.

Features of the compressor include the following: Self-contained—independent of truck motor; easily put on or off truck; direct-connected—no belts; liberally powered—slow speed Hercules engine; highly efficient—two-stage compression, no belt loss, maximum engine economy; completely enclosed.

The compressor has a capacity of 85 cu. ft. free air per minute and a discharge pressure of 100 lb. per sq. in. Its net weight is 1850 lb. and its overall dimensions are: Length, 71½ in.; width, 30 in.; height, 50 in.



Side View of Compressor with Side Covers Removed

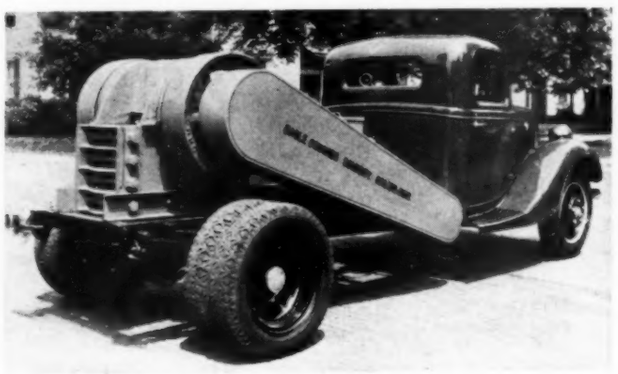
Unit Mounted on Specially Designed Truck Body

▼

Truck Operated Rock Crusher

A portable rock crusher for mounting on any truck chassis has been brought out by the Eagle Crusher Co., Galion, O. The crusher is operated from the truck motor by means of the Hercules split shaft power take-off, which is manufactured by the Hercules Steel Products Co., Galion, O.

The crusher is stated to have a capacity of 6 to 10 tons rock per hour, adjustable to crush from ¼ in. to 2½ in.



Eagle Truck Operated Rock Crusher

Weight of crusher is 4,300 lb. A unit of this type is sold complete with crusher, power take-off, belts and engine governor ready for installing on any make truck—or factory installations are available.

▼

New Concrete Carts

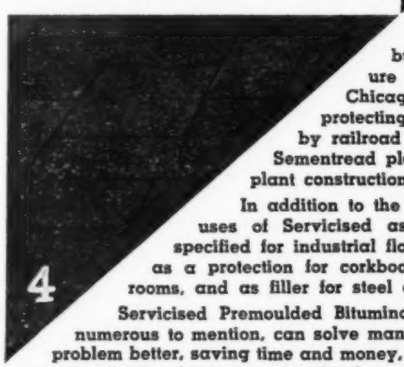
The dumping efficiency of the 42-in. diameter steel wheeled concrete cart, plus the economy and ease of operation of 30-in. pneumatic tired wheels, are claimed for the new RS-30 concrete carts now being marketed by Red Star Products, Inc., Cleveland, O. These carts, made in 6 and 9 cu. ft. capacities, are equipped with an additional set of legs forward, which act as a fulcrum to permit changing the plane of dumping, as in the end dump wheelbarrow.

New Concrete Cart

SERVICISED ASPHALT PLANKING

INDUSTRIAL FLOORING PROTECTION COURSE SIDING

Figure 2 shows Servicised Sementread non-skid planking for bridges. Specifying asphalt plank for roof decks has become common usage with many architects since the World's Fair. Fig. 3 proved its practicability. Figure 4 shows Servicised Rock-Surfaced non-skid planking for bridges. Time-proven standard asphalt plank is used wherever a tough but resilient wearing surface is required—see Figure 5. Recently completed 95th Street underpass, Chicago. Figure 6, has Servicised asphalt plank protecting its membrane waterproofing from puncture by railroad ballast. Figure 7 shows standard and Sementread planking for building siding and power plant construction.



In addition to the above-illustrated, more common uses of Servicised asphalt plank, it is regularly specified for industrial floors and loading platforms, as a protection for corkboard walls of refrigerator rooms, and as filler for steel channel bridge floors.

Servicised Premoulded Bituminous Specialties too numerous to mention, can solve many a construction problem better, saving time and money, as well. Send our engineering department details of your special requirements or problems. If premoulded bituminous material can be used Servicised can make it.

SERVICISED PRODUCTS CORP.
6051 W. 65th ST. CHICAGO

What do You look for in a

TRUCK SHOVEL

Performance
Convertibility
Dependability
Economy
Stamina
Speed

?

model T-6

MICHIGAN

has them all!

WRITE FOR BULLETIN "RS"

MICHIGAN POWER SHOVEL Co BENTON HARBOR, MICHIGAN, U.S.A.

WITH THE MANUFACTURERS

Osgood Co. Moves Its Philadelphia Office

The Osgood Co., Marion, O., has moved its Philadelphia office and is now located at The Wilford Building, Room 126, N. E. cor. 33rd. and Arch Sts., Philadelphia, Pa. (Telephone Evergreen 6650.) Mr. James G. Hoag, who has been district manager in Philadelphia and adjacent territory for some time past, remains in that capacity at the new address. Associated with him is Mr. George P. Greene, from the Marion, O., office. Mr. George H. Shandle has been engaged as office man to handle matters in Mr. Hoag's temporary absences in the territory, and to take care of regular office work.

▼

Gar Wood Enters New Field Manufacturing Rear-Driven Passenger Motor Coaches

Gar Wood Industries, Inc., Detroit, Mich., is now manufacturing a new line of 20 and 24-passenger, streamlined motor coaches. Prices range from $4,500 to $5,200, depending on the interior seating equipment and accessories. It is said that the design and construction are revolutionary. Welded tubular steel is used for the entire structural framework. There is no separate chassis frame; the body unit serves as both body and chassis frame in one integral section. All mechaincal parts are attached directly to the body unit. The motor is placed at the rear instead of at the front or side. Light weight, economy of operation, smoother riding qualities, less inside noise, no inside fumes or odors, better driving vision, and quicker acceleration are some of the many features, it was stated. Stanley E. Knauss is manager of the new motor coach division. For the time being sales activities are to be confined to within a 1,000-mile radius. Later on, they will be expanded nationally.

▼

Rice Now Editor FWD Truck News

Appointment of Arthur H. Rice of Shawano, Wis., as editor of the FWD Truck News, house organ of the Four Wheel Drive Auto Co., Clintonville, Wis., has been announced by Walter A. Olen, President. In addition to editing the magazine Mr. Rice will have charge of the motion picture division of the advertising department. He is a former staff member of the United Press bureau in Milwaukee, and at one time was a member of the staff of the Milwaukee Sentinel. For several years he published the Rosholt Community Press, at Rosholt, Wis., and was an instructor in English and journalism at the Shawano and Rosholt high schools.

▼

Lincoln Electric Appoints New Denver Agent

The Lincoln Electric Co., Cleveland, O., manufacturers of "Shield Arc" welders, Electrodes and "Linc-Weld" motors, announces the appointment of the Intermountain Belting & Packing Co. as its agent in Denver, Colo., covering the State of Colorado and part of Kansas, Nebraska and Wyoming. The salesroom is located at 1414 Wazee St.

▼

LeTourneau Doubling Plant Capacity

Marking the third plant enlargement in little more than a year, R. G. LeTourneau, Inc., builders of Carryall Scrapers and other large capacity earthmoving machinery, have started construction of an addition to the Peoria, Ill., factory that will more than double its present size and capacity. Building cost of the new unit, not including installation of new machinery, will be $75,000.

The present plant is 600 ft. long. Three hundred feet of this length, built in 1935, is 100 ft. wide, plus an office space 30 ft. by 60 ft. The other 300 ft., built this spring, is 160 ft. wide. The new addition will carry this 160 ft. of width for another 600 ft., giving the Peoria plant a total length of 1,200 ft., an area of 174,000 sq. ft.

R. G. LeTourneau, president of the firm, began contracting on land leveling and road construction in 1918. Dissatisfied with the earthmoving equipment on the market at that time, he began revamping it with cutting and welding torches to fit his ideas of greater capacity, simpler, speedier operation. This soon resulted in the start of his own plant to produce equipment to use on his own large operations. The economy and speed with which he completed these jobs created demand for his equipment.

The present Stockton plant was built in 1930 and enlarged in 1932. Its capacity is rated at 1½ scrapers per day. Thus, with the new enlargement to the Peoria plant, the two factories will be capable of 8½ or 9 scrapers per day.

▼

Cutler-Hammer Moves Los Angeles Office

The Los Angeles sales office of Cutler-Hammer, Inc., Milwaukee, Wis., manufacturers of electric motor control apparatus, has been moved to new quarters at 1331 Santa Fe Ave., Los Angeles, Calif. Here they will continue to carry a complete stock of C-H standardized motor control, safety switches and electrical specialties for quick delivery. This office is in charge of Mr. W. G. Tapping, who has had wide experience in handling the complete line of Cutler-Hammer control apparatus.

▼

FWD Awarded $425,000 Contract by U. S. Department of Agriculture

The Four Wheel Drive Auto Co. of Clintonville, Wis., was awarded a $425,000 contract on July 1 for 86 Four Wheel Drive Trucks, by the U. S. Department of Agriculture—Forest Service, Washington, D. C. The FWD trucks are to be used in federal forest service in the Midwest, West, South and Alaska. The order includes 18 trucks of 2½ to 3-ton capacity equipped with dump bodies and hydraulic underbody scrapers; 36 chassis to be used in conjunction with 15-ton low bed trailers; 24 dump trucks of 2½ to 3-ton capacity, and 8 dump trucks of 5-ton capacity.

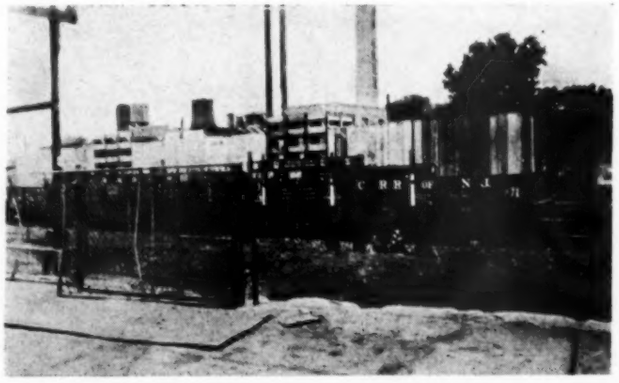
▼

William H. Phillips Rejoins Worthington

William H. Phillips, recently with Harry Pratt Company of Chicago, has joined the Worthington Pump and Machinery Corporation as power plant specialist with headquarters at the corporation's Chicago office. Mr. Phillips was formerly for many years with the Worthington Pump and Machinery Corporation.

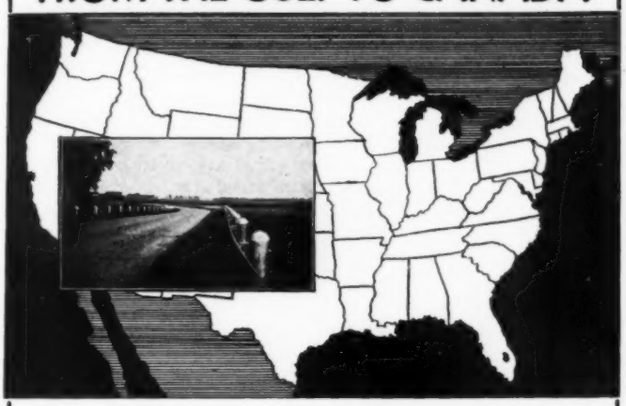
▼

Ransome Mixers for Public Works in Venezuela



The illustration shows part of a recent shipment of Ransome Mixers to the Minister of Public Works of Venezuela, South America. The complete shipment comprised ten No. 10-E Pavers, six No. 10-S Bantam Mixers and six No. 3½-S Tilting Mixers.

FROM COAST TO COAST
FROM THE GULF TO CANADA



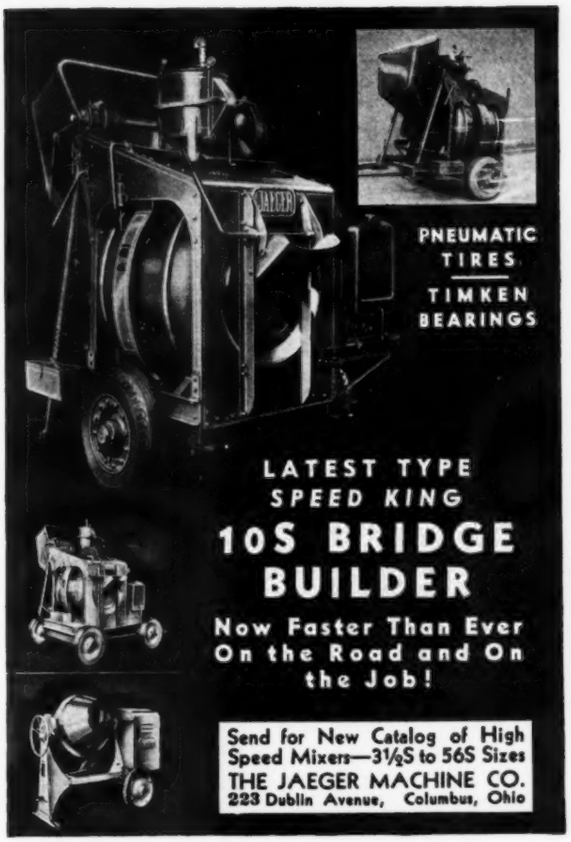
WEJ-LOCK GUARD RAIL EQUIPMENT MEETS ALL STATE SPECIFICATIONS

Wej-Lock guard rail equipment has been approved in every state in the Union and is made to exact state specifications. Write for quotations on Wej-Lock products for cable guard rail.

Cable Ends
Cable Splices
Take Up Fittings
Take Up Splices
Automatic Spring Assembly
Super Guard Rail
Anchors
Tools
Offsets

Everything for Cable Guard Rail

WEJ-LOCK CO. CENTRALIA MISSOURI
DIVISION OF A. B. CHANCE CO.



PNEUMATIC TIRES
TIMKEN BEARINGS

LATEST TYPE
SPEED KING
10S BRIDGE BUILDER
Now Faster Than Ever On the Road and On the Job!

Send for New Catalog of High Speed Mixers—3½S to 56S Sizes
THE JAEGER MACHINE CO.
223 Dublin Avenue, Columbus, Ohio

4TH STREET HENNEPIN AV.

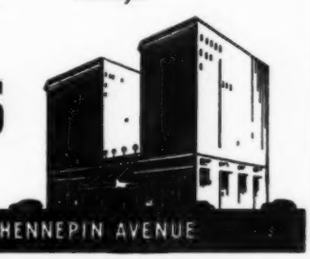
CENTER OF THE CIVIC CIRCLE
in Minneapolis

The Hotel Andrews affords you the opportunity of living in the center of business, shopping and amusement circles. Guests enjoy the pleasing combination of comfortable surroundings, proficient service and savory food for which the Hotel Andrews is nationally known.

Complete Garage Facilities

Rates from $1.50

Theodore F. Stelten
Manager



ANDREWS HOTEL

FOURTH STREET AT HENNEPIN AVENUE

By Preference it's DeWITT OPERATED HOTELS • Genuinely Friendly

In Cleveland it's
The HOLLENDEN

In Columbus it's
The NEIL HOUSE

In Dayton it's
The BILTMORE

In Akron it's
The MAYFLOWER

In Toledo it's
The NEW SECOR

In Savannah (Ga.) it's
The GEN'L OGLETHORPE

In Miami Beach it's
The FLEETWOOD

DeWitt Operated Hotels feature
Unusually Comfortable Rooms at Reasonable Rates and the Finest of Food and Beverages, Carefully Prepared and Served.

ADVERTISING PAGES REMOVED

Link-Belt Expands Shovel, Crane Organization

Announcement is made that Mr. J. C. Bloomfield has joined the shovel, dragline, crane sales division of Link-Belt Co., 300 W. Pershing Rd., Chicago, where he will specialize on the application of Link-Belt machines to railroad service. Mr. Bloomfield has had many years of experience in this field of work, and is said to be well acquainted in railroad circles. L. P. Spillan, for many years a member of the department, has been appointed shovel and crane division sales manager in charge of sales to contractors, with full supervision over all sales agents and distributors. N. A. Weston has been given charge of shovel division industrial sales in the Chicago sales district. G. H. Olson is the company's shovel and division general manager.

▼

Gilbert U. Radoye Named Publicity Director for Gar Wood Industries

Gilbert U. Radoye, well-known publicist, advertising and merchandising man, has been placed in charge of publicity of the various divisions of Gar Wood Industries, Inc., Detroit, Mich. The announcement of Mr. Radoye's appointment as publicity director was made by Mr. Logan Wood, vice-president and general manager of the company. Mr. Radoye came to Gar Wood Industries from a national advertising agency. In the past, he directed publicity for many of the nation's leading manufacturing corporations. The divisions for which Mr. Radoye will handle publicity include the Gar Wood hydraulic hoist and dump body, truck and trailer tank, winch, crane and pole derrick, roadbuilding machinery, heating and air conditioning, automotive and motor coach divisions.

▼

NEW LITERATURE

Concrete Tables—The Pennsylvania-Dixie Cement Corporation, 60 East 42nd St., New York, has issued a booklet containing tables and data based on the most recent developments relating to concrete work. Its purpose is to enable quick estimating of quantities of materials needed for given jobs—to designate the proper types of concrete to use for various kinds of construction—and to determine how to secure concrete meeting requirements of special specifications as to cement content, maximum water permissible, workability, strength, etc. It provides the answer to many problems relating to concrete work.

Asbestos Bonded Paved Invert Pipe—"Asbestos Bonding" is the title of a handsome 12-page booklet just published by the Armco Culvert Manufacturers' Association, Middletown, O. It describes and illustrates how bituminous materially is actually bonded to galvanized metal in such a manner that it will stick indefinitely. In this process, known as "asbestos bonding," the asbestos fibres are embedded in the hot zinc, then saturated with a bituminous material, after which the pipe is coated and paved in the usual way. Although developed primarily for sewer service and severe corrosive conditions, it is equally suitable for highway, railway and other drainage problems where a high degree of permanence is desirable. Free copies of the booklet may be obtained by addressing the Armco Culvert Mfrs. Association.

Data on Tires and Tire Performance—Containing even more statistical information than previous annual volumes, the 1936 edition of the Operators' Handbook has just been published by The B. F. Goodrich Co., Akron, O. Into the 66 pages of the handbook has been packed detailed data on tires and tire performances of interest to owners and operators of trucks, buses, and tractors. Listing every ordinary type tire and tube which the Goodrich Co. manufactures for truck, bus or tractor service, the volume lists the specifications on each, including the size, number of piles, rim, section width, tire diameter, carrying capacity, loaded radius and air pressure and describes the service for which each type tire is suited. One page is devoted to a discussion of "Why Tires Fail"; two pages to a description of the new tire calculator designed to reveal exact truck tire costs, and the methods of its operation; and 48 pages to specifications on tire and tube lines. "Factors Governing Proper Tire Selection" are discussed in two pages, one of which is a load and service diagram, illustrating the effects of overloading on the ultimate service of a pneumatic tire. The easiest way to determine tire loads is related in two pages, while another two pages are devoted to a load and inflation table, giving correct inflation on each size tire and the carrying capacity in pounds. Three pages are given over to a discussion of the correct methods to determine tire cost per mile, and its importance in economical operation of vehicles. One of the most interesting sections of the booklet is the five pages devoted to a table of weights and measures, listing practically all commodities. Copies of the Operators' Handbook are available upon request to The B. F. Goodrich Co., Akron, O.

Multifoote Pavers—A handsome catalog describing the new 27 cu. ft. paving mixer produced by The Foote Co., Nunda, N. Y. Supplementing the clearly written text are many illustrations showing details of drum, boom, bucket, control mechanisms, transmission, power unit, and traction mechanism. Specifications give all major dimensions.

There are also brief descriptions and general views of the Multifoote Tower Hoist, Adnun Fine Grader, and Adnun Black Top Paver.

"Caterpillar" Diesels—After executives of Caterpillar Tractor Co. had watched their 10,000th Diesel leave the assembly line last November, one of the officials voiced a new idea. "Let's find out," he exclaimed, "what old No. 1 Diesel, No. 1000, No. 2000, and so on, are doing!" And this idea has taken form in an attractive booklet just issued by the company, "The Story of Ten 'Caterpillar' Diesels." The book required considerable investigation and correspondence, for some of the Diesels had gone far. But their story is interestingly told, and the whole is an admirable and adequate cross-section of the parts that more than 14,000 Diesel tractors and engines manufactured by the company during the past 4½ years, are playing in construction, agriculture, logging and industry. Copy may be obtained from the Caterpillar Tractor Co., Peoria, Ill.

⅜-Yd. Full Revolving Excavator—The new Type K ⅜-yd. full revolving excavator of the Insley Manufacturing Co., Indianapolis, Ind., is fully described in catalog No. 112, just issued. Numerous photographic illustrations are given, together with drawings showing operating radius of the excavator as a shovel, with trench hoe attachment and with dragline and clamshell. The various features of the machine are illustrated and described, and the general specifications are given.

Concrete Machinery—A convenient 28-page catalog has been issued by the Ransome Concrete Machinery Co., Dunellen, N. J., covering its line of concrete machinery. Each piece of equipment is illustrated and brief description is given.

Compressors—An attractive bulletin (C36) has just been issued by the O K Clutch & Machinery Co., Columbia, Pa., describing its full line of air compressors.

Compressors, Rock Drills, Air Tools—A handy 16-page folder covering equipment for the contractor has been issued by the Worthington Pump and Machinery Corporation, Harrison, N. J. Illustrations of drills and various tools are given together with brief descriptions.

Large Scraper—R. G. Le Tourneau, Inc., Peoria, Ill., has just issued a broadside covering its carry-all scrapers. Several job pictures are shown. The various important features of the Type Y 12-yd. carry-all scraper are described.

Road Maintenance and Construction Equipment—A new catalog covering the above line of equipment has just been issued by Littleford Bros., 454 E. Pearl St., Cincinnati, O. The catalog is a lithographed job, containing 24 pages of illustrations and facts concerning about 93 different units of Littleford Road Maintenance and Construction Equipment. There are 98 illustrations and diagrams shown.